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THE GRASSLANDS OF NEW ZEALAND.

SERIES II. NORTH ISLAND HILL COUNTRY.

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GRASSES AND CLOVERS FOR HILL COUNTRY—*continued.*

(6) Brown-top (*Agrostis tenuis*).*

IN the past few grasses have been more despised than brown-top, and even at the present time comparatively few people advocate its use. On arable land the name "brown-top" is anathema; by its behaviour in that situation it is rightly included among the twitches. On short-rotation grassland soils it is blamed largely for the going-out of the better grasses and clovers—perennial rye-grass, cocksfoot, crested dogstail, white clover, &c.—and its presence there is often made the sole reason for the ploughing-under of the pasture. Again, on extremely poor soils where it mats and becomes sod-bound it is scorned and considered of no value.

In previous articles of this series I have endeavoured to show that the habitat range of the better species is limited to the better-class soils where the soil-fertility is high or moderately so. Between the cocksfoot, crested dogstail, Poa pratensis, and white clover soil-type on the one hand and the Danthonia pilosa and suckling-clover type on the other hand lies the brown-top type. On this soil-type brown-top is the best grass the farmer can use. No grass indicates the soil-type and the standard of soil-fertility better than does brown-top; and the recognition of this fact, together with application by the farmer to the problem of changing this type so that brown-top dominance no longer is possible, affords one of the big forward grassland moves open to him at the present time. Aggressive as brown-top is, it is no match for strong-growing perennial rye-grass, cocksfoot, crested dogstail, and white clover; but just so soon as these species show signs of weakening—in other words, so soon as they are inadequately fed—brown-top can beat them in production, and in virtue of this fact it is in a position in such a pasture sward to dominate the association.

* For a botanical description of brown top, and comparison with red-top and creeping-bent, see this *Journal* for February, 1924.

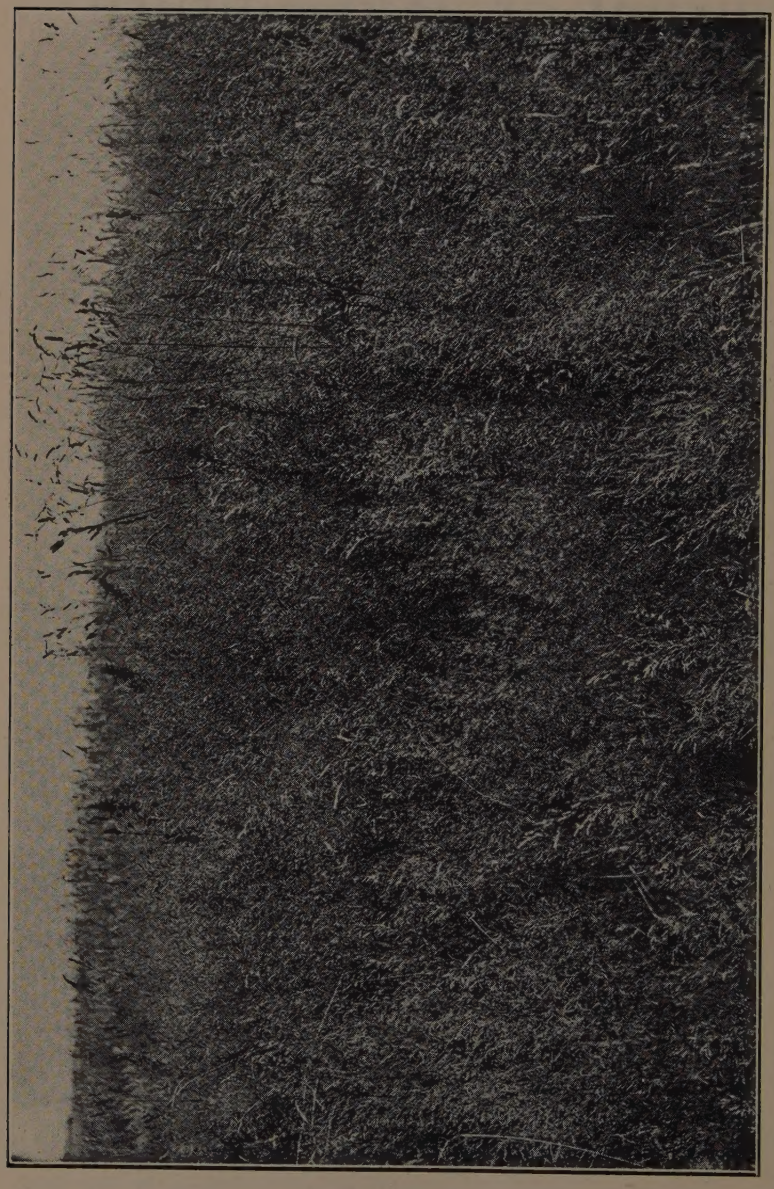

FIG. 105. SHOWING BROWN-TOP DOMINANT IN GRASSLAND.

Brown-top occupies a soil-type intermediate between the cocksfoot, crested dogstail, Poa pratensis, and white clover soil-type on the one hand and the Danthonia pilosa and suckling-clover type on the other. A little cocksfoot is persisting in the sward shown.

[*Photo by E. Bruce Levy.*

(Fig. 105.) By its growth it rapidly further depletes the soil of the available plant-food, and a further dwindling of the once dominant rye-grass, cocksfoot, crested dogstail, &c., takes place, until finally is seen the typically run-out brown-top pastures too frequently met with on easy ploughable country at the present time.

At this stage of the present series I wish to make this point perfectly plain. We have, as it were, come to the dividing of the ways. Just above the brown-top standard of soil-fertility is milk-production, be it of the dairy cow or of the ewe; below the brown-top standard sustained milk-production is quite impossible. The brown-top standard of soil-fertility, then, is the dividing-line between wet-stock farming and dry-stock farming, excepting perhaps for a very limited period in the spring when annual clovers are helping on the milk-flow.

The limiting factor in pasture-production, and one that can be made good almost immediately, is that of available plant-food. Virtually all those soils that run to brown-top are sufficiently moist to render available any artificial manure applied; hence I feel safe in asserting that wherever artificial fertilizers can be got economically on to the ground the manuring-out of brown-top and the manuring-in of rye-grass, cocksfoot, crested dogstail, and white clover is capable of accomplishment. That forlorn hope of wishing for something better than brown-top without doing anything to improve the conditions for plant-growth must be abandoned; it may be taken that once the average farmer understands better why brown-top comes in and fills the position previously occupied by the better species sown by him he will endeavour, as far as lies in his power, to so manage the conditions that the grassland habitat may remain one for the better species to continue to thrive in. The manuring-out of brown-top and the manuring-in of rye-grass, cocksfoot, crested dogstail, and white clover should be regarded as a grassland maxim. (Fig. 106.)

The important fact for every farmer to bear in mind is that in the case of ploughing up a paddock predominantly brown-top and sowing it down to grass again, unless subsequent and regular top-dressing is done, as soon as the ameliorating effect of cultivation and of the manure applied at the time of sowing wears off, natural equilibrium between the pasture growth and the natural plant-food resources of the soil will soon come about, and in some three years' time the pasture will once more run to brown-top. These two truths—(1) that brown-top can be manured out, and (2) that soils running to brown-top dominant have become too poor for rye-grass, cocksfoot, crested dogstail, Poa pratensis, and white clover—are fundamental, and their recognition should go a long way towards putting grassland farming on second-class soils in a much better and more lucrative position. The actual cost of raising the fertility from brown-top to, say, rye-grass and white clover standard has not yet been determined, but it is hoped almost immediately to initiate experiments for the determination of this point. I am inclined to think that the amount of manure necessary will not be alarmingly great, but that regular manuring will be absolutely essential.

Where the farmer is thrown back upon the natural plant-food resources of the soil—in other words, where it is uneconomical to apply manure owing to heavy transport charges, and where such weeds as

catsear, hawkweed, dandelion, rib-grass, plantain, selfheal, field-daisy, cudweed, &c., are on the increase in his pastures—there is no doubt in my mind that there is a place for brown-top, a place which no other grass now known in this country can fill.

The brown-top soil-type may be defined as moderately wet, often sour, rather cold and stiff, and low in available plant-foods. Among such are the consolidated peat-swamps, drained and consolidated pakihi, better-class gum-lands of the Auckland Province, typical short-rotation soils of Southland, North Otago, South Canterbury, foothills of the Southern Alps, Westland, Wairarapa, and Marton-Turakina district. Further, all hill country is comprised of various soil-types, among which the brown-top type figures more or less largely. On all the poorer types of hill country there is a phase in the succession from rye-grass, cocksfoot, crested dogstail, Poa pratensis, white clover, &c., to danthonia dominant where brown-top should figure as the dominant for a shorter or a longer period. (Fig. 108.) The present-day success of large tracts of hill country in the Wairarapa and other parts is due largely to the brown-top phase intercalated between the two other phases mentioned. Conversely, the failure of large tracts on the west coast of the North and South Islands is due largely to the fact that brown-top never has become firmly established on those areas. The running-out of the better grasses and their replacement by shade-creating weeds, such as bracken fern, hard fern, manuka, piripiri, &c., not only soon reduces the stock-carrying capacity but creates conditions wholly unsuitable for the incoming and successful establishment of danthonia.

For soils, therefore, where it is manifestly impossible to maintain the better grasses indefinitely brown-top should figure in the mixtures sown in order to take up the running as conditions harden, when the effect of cultivation, &c., wears off, or as soon as the ash of the primary burn disappears. It will seem a bold step to include brown-top in the seed mixture sown on ploughable country, but I firmly believe there would be a much lesser amount of weeds of the catsear and rib-grass type present in pastures to-day had some brown-top been used.

In 1921 the Department of Agriculture laid down at the Central Development Farm, Weraroa, a series of small plots, the mixtures containing perennial rye-grass and white clover as a base and one other additional species per plot. In one plot the mixture sown was perennial rye-grass, 15 lb.; white clover, 2 lb.; and brown-top, 5 lb., per acre. This plot was sown on good-quality soil, typically rye-grass and white clover standard of soil-fertility. Right from the time of sowing up to the present day perennial rye-grass and white clover have remained dominant, brown-top showing only in one or two weaker parts of the plot. On this soil-type brown-top could be quite eliminated from the sward with small amounts of top-dressing. Fig. 107 also depicts a similar state of affairs. This particular paddock is in Southland, on the farm previously owned by Mr. W. D. Hunt. It is on soil which in the ordinary course of events runs to brown-top in three to four years after sowing down with the typical short-rotation pasture mixture. The area was limed and top-dressed with phosphate regularly every three years, and at time of taking photo the paddock had been down for thirteen years and was dominantly rye-grass, cocksfoot, crested dogstail, Poa

FIG. 106. PERMANENT PASTURE BROUGHT BACK FROM BROWN-TOP DOMINANT TO RYE-GRASS AND WHITE CLOVER DOMINANT BY TOP-DRESSING.

The manuring-out of brown-top and the manuring-in of rye-grass, cocksfoot, crested dogstail, white clover, &c., should be regarded as a grassland maxim.

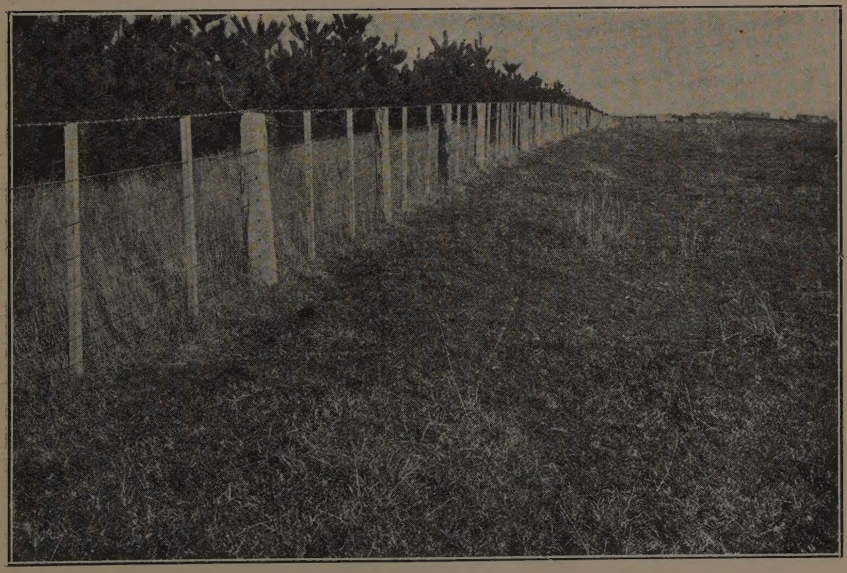

FIG. 107. EXCLUSION OF BROWN-TOP FROM SWARD BY MANURING.

On right, top-dressed pasture with rye-grass, cocksfoot, crested dogstail, Poa pratensis, and white clover dominant ; through fence, on left, where there has been no top-dressing, brown-top dominant. Pasture thirteen years old, and no spread of brown-top into the strong-growing sward.

[*Photos by E. Bruce Levy.*

pratensis, and white clover, while through the fence, where was originally the same turf, brown-top was dominant and seeding freely. These two examples serve to show that so long as the standard of fertility is kept up to the standard required by the better grasses and clovers brown-top may be sown in the mixture, or may seed freely in an adjacent paddock, yet it is impotent against the rye-grass, cocksfoot, &c., combination while these species are producing well and forming a closed turf.

A second experiment was carried out at Weraroa on the stony part of the farm, a soil-type much poorer than the one just referred to and off the typical rye-grass country. A general mixture of rye-grass, cocksfoot, crested dogstail, and white clover was sown, and on one portion a strip approximately 2 chains wide across the paddock was sown with brown-top additionally. In the first two years very little brown-top could be seen, and up to the end of the fourth year the brown-top confined itself to the sown portion. The growth was strong and an excellent seed crop of brown-top could have been harvested. After the fourth year brown-top spread at a great rate into the neighbouring weakened cocksfoot, crested dogstail, and white clover sward, necessitating ploughing up and resowing the area. The explanation of this behaviour, in contrast to that already cited on the better soil of the farm, is accounted for entirely by a change in the soil-condition. While the effect of cultivation and of the manure applied at time of sowing lasted, the rye-grass, cocksfoot, crested dogstail, and white clover were able easily to subdue the brown-top. At the end of the second year certain of this effect had worn off ; the rye-grass first weakened and went out, leaving bare ground, and this ground rapidly filled with brown-top. In the third and fourth years rapid weakening of the cocksfoot, crested dogstail, and white clover followed generally over the paddock, and this weakening of the cocksfoot, &c., marked the rapid spread outward across the paddock from the sown brown-top portion. No top-dressing whatever was applied to this paddock, otherwise I feel certain there would have been quite a different story to tell.

The fact was mentioned that in the third and fourth years a good brown-top seed crop could have been harvested. In view of the possibility of working up a good export trade in the seed, this method of securing good clean crops of brown-top is worthy of some consideration ; at the present time the best Chewings fescue seed crops are produced by the sowing-down of short-rotation pasture in which is included sufficient seed of Chewings fescue to give a complete cover as soon as the rye-grass, &c., goes out. At the present time it is from volunteer brown-top growth that the seed crops are produced ; such growth for some years following on the short-rotation pasture is patchy, and it is not for some time that a payable crop can be produced. Then, again, the crop is somewhat uneven, as the first-formed patches have weakened somewhat, and consequently a less uniform line of seed is produced.

BROWN-TOP AS PIONEER.

Just as brown-top fills an important phase on most hill country in the succession from rye-grass, cocksfoot, &c., to danthonia, so it is found on very poor soils, or on soils the mechanical condition of which mitigates against rapid improvement to enable the better grasses and clovers to thrive, that brown-top comes in as a pioneer, and such

FIG. 108. BROWN-TOP PHASE IN THE SUCCESSION ON HILL COUNTRY.

The rye-grass, cocksfoot, &c., have almost entirely gone out. Brown-top is dominant in foreground, while in mid-centre and background Danthonia pilosa is dominant on a slightly poorer aspect. Photo shows well the habitat relationship between these two species.

FIG. 109. MIXED PASTURE WITH BROWN-TOP AND LOTUS SPECIES DOMINANT ON TYPICAL GUM-LAND, NORTH AUCKLAND.

Such a sward can be cheaply secured by sowing down a mixed pasture and by subsequent applications of artificial manures. By its growth and productiveness it prepares the way for better-class pasture as humus content of soil increases and fertility is gradually built up.

[Photos by E. Bruce Levy.

soils by a gradual series of steps upward may ultimately be enabled to carry high-class pasture. Provided the rainfall is not a limiting factor, there seems to be infinite possibilities in the development of poor land that can be conveniently manured. But it would probably be expecting too much for such soils to rapidly build up to rye-grass, cocksfoot, &c., standard at the offset; rather should one first aim at a mixed pasture with brown-top dominant. (Fig. 109.) This can be secured at moderate expense, and with the brown-top pasture as a basis, after the accumulation in the surface layer of soil of a supply of humus, additional top-dressing is sufficiently effective to bring into being a sward with the better grasses dominant.

Such a succession is not possible, of course, unless a fairly good representative seed mixture is sown prior to the building-up of fertility. As an example of such pasture renovation and improvement I cannot do better than quote the case of Mr. W. P. Levy, in the Henderson district, near Auckland. His farm is on typical gum-land, the vegetation in the virgin state consisting of stunted manuka, Pomaderris phylicæfolia, Hakea acicularis, and in the more open spaces Danthonia semiannularis. In this virgin state the soil-type grades low down in the series, and when sown to grass and left unmanured the pasture rapidly deteriorates and becomes stunted, brown-top dominant, with danthonia increasing each year. Five years ago Mr. Levy started to work on such a worn-out stunted brown-top and danthonia turf. The first essential was to break the sod-bound turf by ploughing in narrow furrows, or by heavy disking followed by heavy tripod harrowing. (Fig. 110.) As soon as the soil was aerated in this way top-dressings of artificial manure were applied at the rate of approximately 2 cwt. per acre per annum. The first response to such treatment was a strong and vigorous growth of brown-top, Lotus major, and Lotus hispidus, and for three years payable seed crops of these were produced. With further top-dressing and tripod harrowing the composition of the sward changed considerably, and on the better portion of the farm cocksfoot, white clover, red clover, and even rye-grass grew so strongly as to render the area quite unsuited for brown-top-seed production. This season brown-top-seed production has been abandoned, and the area is now devoted to dairying. In my opinion there seems no reason why permanent high-class pastures should not be produced on this area so long as regular manuring and tripod harrowing are carried out. In this example is first seen the complete elimination of the danthonia and the rise to dominance of brown-top, Lotus hispidus, and Lotus major (harvested three years for seed), and finally the incoming of rye-grass, cocksfoot, and white clover additional to the brown-top and lotuses. It should be firmly borne in mind, however, that without the brown-top and lotus phase the rise to the better species dominant could not have been so economically effected. It is a question of building step by step, and one of those steps is the brown-top dominant phase.

In another respect brown-top is a good pioneer on certain soils that are loose and unconsolidated. By its underground root-stock it ramifies through the loose or peaty soil and helps to bind the soil together, and by its ability to produce feed stock are encouraged to tread and thus to consolidate the surface, all of which hastens the time when a seed-bed or growing-place is formed for the better grasses and clovers.

FIG. 110. REGENERATION OF SOD-BOUND BROWN-TOP BY PLOUGHING IN NARROW FURROWS.

Such practice aerates the soil, and the underturned turf when rotted provides increase of fertility for the surviving plants along edge of furrow. Excellent seed crops may be produced in this way. Subsequent heavy tripod harrowing and manuring will finally lead to an excellent pasture.

FIG. 111. BROWN-TOP POOR AND STUNTED ON LOW-FERTILITY SOIL.

On such soils the yield from brown-top is low, and soon a matted sod-bound stage is reached. Such stage is a clear expression of starvation conditions for brown-top.

[*Photos by E. Bruce Levy.*

BROWN-TOP ON VERY POOR SOIL.

If brown-top is sown on a soil below the brown-top standard of soil-fertility, or if the soil-fertility becomes depleted, this grass mats badly and soon produces that characteristic sod-bound state which has so often led to the condemnation of brown-top as a useful pasture species. (Fig. 111.) As in the case of Poa pratensis or paspalum, the sod-bound state is but a clear expression of starvation conditions as far as brown-top itself is concerned, and the remarks made concerning this state in paspalum pastures (see *Journal* for December, 1926, page 365) equally well apply to brown-top. Brown-top when sod-bound opens up somewhat and allows entry of species below it in the fertility scale, but, as one would imagine, the grass that is capable of entering and spreading within a sod-bound brown-top turf must be specially suited to an extremely hard set of environmental conditions. Suffice here to say that when brown-top mats and becomes sod-bound it is outside its habitat range and is on a soil-type for which certain other species are essentially more suited. Such species will be dealt with later.

BROWN-TOP ON ARABLE LAND.

On arable land specially set aside for annual crop production brown-top is one of the worst of weeds, and is well included among the twitch-grasses together with creeping-fog (*Holcus mollis*), old-man twitch (*Agropyron repens*), and Poa pratensis.* On such cultivated soils, even though within a comparatively dry region, brown-top may form very luxuriant growth on the cultivated field and yet soon fail on the same area when cultural operations cease and consolidated soil conditions again rule. Here under pasture conditions brown-top is obviously outside its habitat range, and I would not class these dry soils where top-dressing response is so very small as among those where stunted brown-top could be rejuvenated and the grassland improved, as in the case of the wetter gum-land area before cited. The cultivation of the soil increases fertility owing to the ameliorating influence of sun and air, and conserves moisture, so that brown-top may thrive well under such highly modified conditions, but when cultivation again ceases the water-holding capacity of the soil is greatly reduced and the soil-moisture content becomes a limiting factor. On such soils, then, permanent grassland of good brown-top or better type is almost out of the question, and hence such areas must be regarded as essentially suited to short-rotation pasture and annual crops. On such land brown-top is undoubtedly a bad weed.

BROWN-TOP AS A BINDING ELEMENT IN HILL-COUNTRY TURFS.

What has been written regarding the mechanical value of Poa pratensis in binding the turf (*Journal*, September, 1926, p. 149) may equally well be said of brown-top. There is one great exception, however—namely, that brown-top will persist and thrive on soils of moderately low fertility and retain a close and continuous cover, whereas Poa pratensis on such soils will dwindle and open up. Fig. 78 in the above-quoted issue of the *Journal* gives some little indication of the

* Methods for eradication of brown-top from arable land are given by F. W. Hilgendorf in "Weeds of New Zealand," pages 31–32.

FIG. 112. BROWN-TOP SPREADING INTO SOMEWHAT OPEN BRACKEN FERN ON SHADY SLOPE.

A certain amount of feed is produced under this condition, and stock are enticed to graze the area. Repeated firing or crushing to remove the shade of the fern also assists spread of the brown-top.

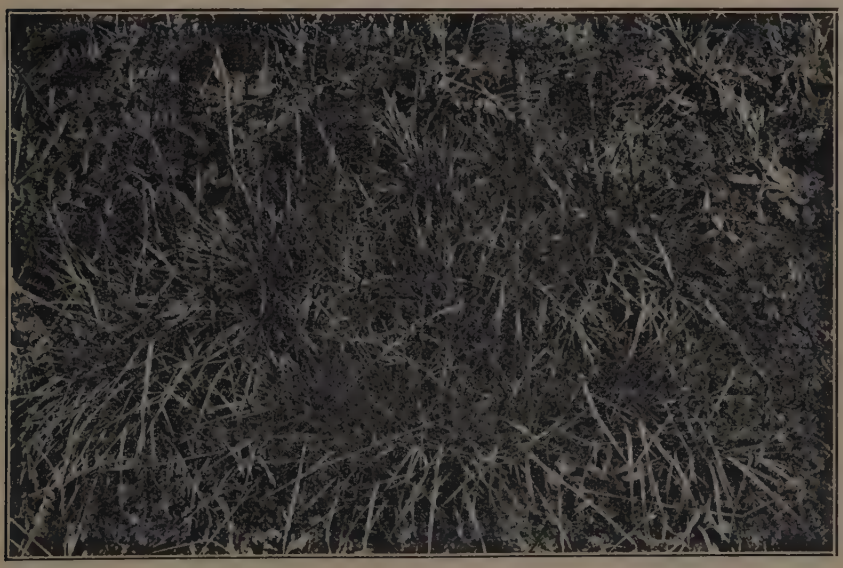

FIG. 113. BROWN-TOP RECOVERING AFTER BRACKEN-FERN FIRE.

Too dense a shade will kill the grass; hence repeated firing or crushing of the fern is necessary in the initial stages to enable the grass to tiller and spread.

[*Photos by E. Bruce Levy.*

behaviour of these two species on the same rather poor soil-type. On the right of the photo Poa pratensis is seen dwindled and the turf opened up, whereas on the left brown-top is gaining in the pasture, forming quite a dense turf, and under these conditions is easily beating the Poa pratensis in production.

BROWN-TOP UNDER SHADY AND SECONDARY-GROWTH CONDITIONS.

Brown-top is an excellent shade-endurer and ranks as the most important all-round grass for coping with secondary growth. What has been said of paspalum in the *Journal* for December, 1926 (pages 373–74), can equally well be said of brown-top, and this latter grass is not so limited in its distribution either in regard to the poorer soils or in its temperature requirement. Brown-top will thrive equally well in North Auckland and in Southland, at sea-level and well up mountain-slopes. Further, brown-top is capable of peculiar development under dense and tall shade. Normally the plant is capable of spread by means of underground stems, a fact that arable-land farmers know only too well. It would appear that under shady conditions the plant has the ability of converting these normally underground stems into aerial stems, which as they arise among the secondary growth give off lateral vegetative shoots; by this means the foliage is raised into the light, and as a consequence the normal living functions of the plant may be carried out.

In hill country it is on the shady slopes particularly that the value of brown-top comes in. The sunny slopes are easier to get into danthonia than are the shady ones. But brown-top being a better shade-endurer than danthonia can make headway into secondary growth on the shady slopes, provided that such growth is not too dense, whereas danthonia is impotent on such slopes. Large tracts of bracken-fern country in the southern part of the Nelson District are being brought back to grassland by means of these two pasture species. Danthonia is spreading into the weaker, more open fern lands on the sunny slopes, and brown-top is working similarly on the shady slopes (Fig. 112). These grasses working through the fern are a draw to stock; again, their presence there ensures better burning of the area, and after a fire gives a tasty bite; therefore stocking of these fern areas becomes more intensive, and, after all, as far as secondary growth is concerned, the matter is largely one of increased stocking for its control. The more stock, particularly cattle, that can be maintained (not starved) on an area, the better for the grass and the more likelihood is there of controlling the secondary growth. In Westland brown-top is also invading areas of the more stunted blackberry, and not only is it providing a draw to stock, but, as mentioned in the case of paspalum (*Journal*, December, 1926, p. 375), it helps to form a tight turf about the crown of the blackberry-plant, which aids greatly in control of the latter on steep unploughable country.

Brown-top carries a fire well, and recovers rapidly after burning (Fig. 113). No expense, therefore, is necessary in sowing further seed of this species on such a secondary-growth burn, which principle is indeed the very keynote for success in dealing economically with hard secondary-growth country (*Journal*, June, 1927, pages 368–69).

FIG. 114. BROWN-TOP SWARD GROWING ON PUKAHU ON PRIMARY BURN.

The better pasture species simply wilt off on pukahu areas, but brown-top, owing to its strong underground root-system, can persist. By its growth it encourages the treading of stock, thus consolidating the surface. After some years brown-top may mat badly on pukahu areas, but by its growth it has helped to keep out fern and to prepare the way for any danthonia established along with it.

FIG. 115. BROWN-TOP MATTED ON PUKAHU AND BEING REPLACED BY DANTHONIA.

The large outspreading plant in centre of photo (enclosed by dotted line) is Danthonia pilosa spreading quite rapidly and replacing the stunted brown-top.

[Photos by E. Bruce Levy.

The final objective is to be able to burn off any secondary growth, or to crush it out and get a volunteer return growth of suitable species. Brown-top can well claim to be one of such species.

BROWN-TOP ON PRIMARY AND SECONDARY BURNS.

Brown-top should be included in all primary- and secondary-burn to grass mixtures. The plant readily establishes from seed, and in the first year it throws quite an appreciable amount of feed. On the primary burns it is seen at its best on the harder portions of the burn, where such species as rye-grass, cocksfoot, crested dogstail, &c., are not quite at home. By means of its creeping underground root-stocks it ramifies through pukahu and similar unconsolidated portions of the burn, and by its growth it serves as an inducement for stock, which consolidate somewhat by their treading these loose areas (Fig. 114). On richer portions of the burn brown-top is scarcely in evidence, being overcome there by the stronger-growing rye-grass, cocksfoot, &c. This is one of the conspicuous features of a new primary burn, and the patchy nature of the brown-top is apt to lead to the conclusion that the seed had been badly mixed or badly sown. But when such a case is examined carefully it is nothing more or less than an arrangement of the species among themselves according to habitat. Where the conditions are good enough for rye-grass, cocksfoot, &c., these will be dominant, and they will remain dominant just so long as the soil conditions remain uniform. But on the harder knolls, pukahu areas, &c., brown-top will be found dominant.

On all bush burns after a few years there is a general reduction of fertility over the whole area. On those portions where rye-grass, cocksfoot, &c., were once dominant there is an opening up, and such open spaces will be filled by one plant or another. If brown-top is established initially on the harder portions, seed shed from plants growing there will fall and germinate on these bare patches and fill them up, thus keeping a close and continuous turf. On the harder knolls and pukahu areas, which also become correspondingly poorer due to loss of ash, &c., the brown-top dwindles and in a few years mats and becomes sod-bound. This matting on the poorer areas often creates a bad impression in the mind of the farmer for brown-top, and he is often apt to recognize only these matted patches as that grass and to call brown-top growing stronger on a better portion of the burn one of the "English grasses," such as rye-grass or Poa pratensis.

It may be taken as a general rule that all that soil-type where kamahi, hinau, and rewarewa comprise the dominant forest-trees holds brown-top well, whereas the better grasses soon disappear. After some years on such a soil-type the brown-top may mat somewhat, but if danthonia is also in the mixture this matting on the harder portions is not a serious matter (Fig. 115) and must be regarded simply as the response of brown-top to the now poorer conditions ruling; in other words, that particular aspect has become outside the habitat range for brown-top to thrive in.

Without some means of fertility maintenance on our hill country it would appear almost certain that the majority of the country is destined to run finally to danthonia, but even where a Danthonia pilosa sward is the objective the addition of brown-top to the original mixture sown is

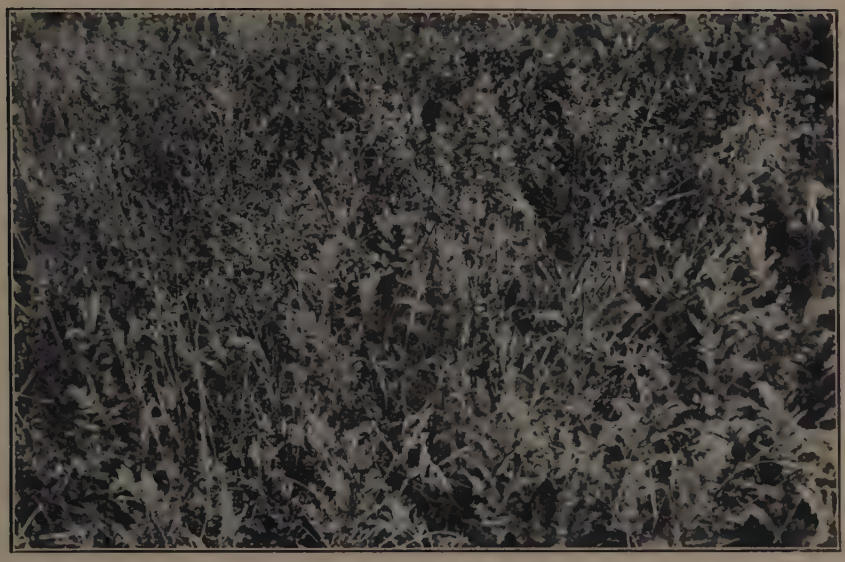

FIG. 116.—BROWN-TOP ESTABLISHED IN PATCH OF HARD FERN.

Once establishment is thus effected the area may be burned at any available opportunity, and it is quite unnecessary to sow any more seed of brown-top. This illustrates a fundamental principle in secondary-growth control.

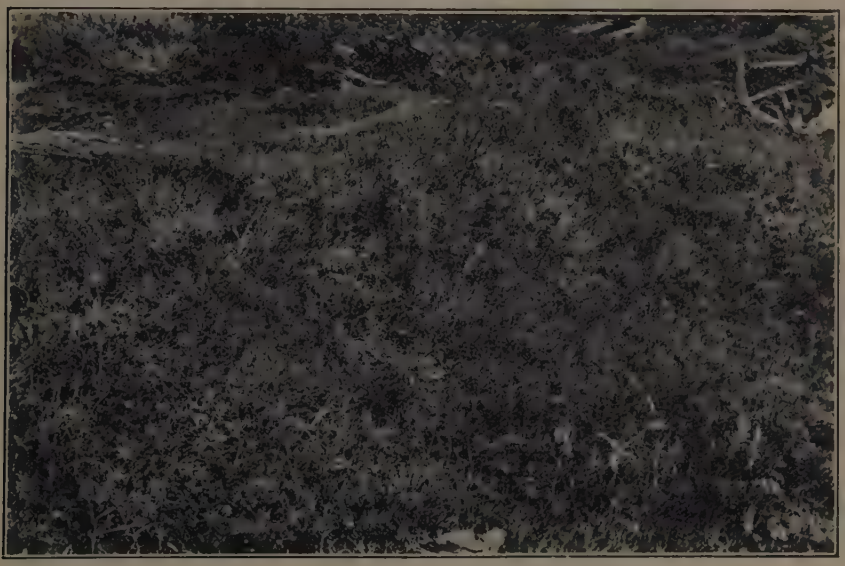

FIG. 117. KNOLL WHERE HARD FERN HAS BEEN ENTIRELY REPLACED BY BROWN-TOP.

On the wetter bad hard-fern country this stage may take some time to reach, but the principle is sound. Photos of Figs. 116 and 117 taken on farm of Jepson Bros., Otaki Forks.

[*Photos by E. Bruce Levy.*

highly desirable. In a great deal of the wetter hill country, of the west coast particularly, the incoming of the secondary growth has been too rapid to enable danthonia to get a good hold before being smothered out. The ground surface becomes shaded by the secondary growth, and under shady conditions danthonia dwindles and then goes out. A sward of brown-top will help greatly to keep out the secondary growth. It will thus allow the light to reach the ground surface, and hence afford a better opportunity for danthonia established along with it to spread. Thus, even though the soil condition may ultimately become too poor for brown-top to thrive well, its presence prepares the way for spreading of the danthonia. For these reasons 1 lb. of brown-top seed per acre should be included in all primary-burn mixtures.

On secondary burns brown-top should be regarded as fundamental. It establishes rapidly, its cover cost is low, the seed is very small and thus escapes birds, it holds on almost any soil-type sufficiently long to enable danthonia established with it to become firmly rooted, and when it mats it opens up sufficiently to allow opportunity for shed danthonia-seed to germinate and to become established within it, thus ensuring a close and continuous turf right from the offset. The relative importance of brown-top on the secondary burn is shown very clearly in the tables printed in the *Journal* for March and June, 1927, recording the preliminary results of experimental sowing on secondary-growth country. An amount of 2 lb. per acre of brown-top seed should be included in all mixtures for secondary-growth burns where there is no brown-top showing prior to the burn ; but once this grass is well established on the area, in any subsequent burning done there should be no need to sow any more of it. When this stage is reached the area should be burned at every available opportunity until the secondary growth is entirely destroyed. Brown-top will come away strongly after each burning, but the hard fern, &c., will be considerably damaged each time, and as soon as one is able to weaken the fern the grass gets a better chance. The more compact the turf the poorer and poorer the fern growth becomes, until finally it is completely wiped out (Figs. 116 and 117).

CONCLUSION.

Ecologically, brown-top is one of the most interesting grasses, and from a practical standpoint the study of its behaviour is full of value. Occupying a position as it were on the border-line between two fundamentally different types of farming (wet-stock and dry-stock farming), naturally it is difficult to place an account of the grass before the farmer in the right perspective. On the one hand its incoming has been a boon for thousands of acres ; on the other hand its increasing dominance is a sign of insidious deterioration. Under one set of conditions every effort should be made to encourage its growth and spread ; under another set of conditions the effort in the future is to eliminate it from the sward—to manure it out.

Brown-top is an excellent indicator of soil-conditions, and really although very widespread throughout the country its habitat range as far as soil-type is concerned is not very great. The important point to get firmly established is the fact that its increase in the pasture is largely due to the conditions being unsuitable for anything better to thrive, and in its deteriorated state it is matted and sod-bound because it is starved. As a successional species on hill country it prepares the way for

FIG. 118. BROWN-TOP DOMINANT ON PRIMARY BURN.

The sward here seen shows a stage at which white clover, crested dogstail, and some rye-grass and cocksfoot are still persisting. Such a pasture is excellent for milk-production, and the brown-top will be found as palatable as any other species showing. At this stage very little manuring would be necessary to bring the sward back to dominance of the English grasses. [*Photo by E. Bruce Levy.*

danthonia dominant on poor soils where fertility upkeep is out of the question, and in the breaking-in of naturally unfertile ploughable country it forms an important step in the succession upwards to rye-grass, cocksfoot, &c. If thriving well the grass is highly palatable when young, but as soon as it starts to get away rank stock neglect it almost entirely. Quite a small amount of fertilizer greatly increases its palatability, and when top-dressed to the stage where white clover and crested dogstail once more begin to associate with it this combination is excellent for milk-production (Fig. 118). When matted and sod-bound the herbage is quite unpalatable and the growth yield is exceedingly small.

Once more the plea may be made on behalf of our grasses and clovers to recognize that each has a definite habitat; each has a standard set of conditions which must be provided before that species can produce its best. It is for the farmer to provide the necessary conditions.

(Series to be continued.)

AGRICULTURAL LEGISLATION OF 1927.

(Concluded from December issue.)

F. S. Pope, Acting Director-General of Agriculture, Wellington.

ORCHARD-TAX ACT, 1927.

The Act under which orchard-tax has been payable since 1917 expired on 31st December, 1926. The Act of last session was passed firstly to take the place of the defunct enactment, and secondly to enable a special tax to be levied in commercial fruitgrowing districts, in cases where the growers so desire, in order to provide funds with which to combat fireblight.

The provisions of the new Act, in so far as they relate to the general orchard-tax, are, however, somewhat different from those of the expired statute, the main points of divergence being as follows: Formerly the tax was at the rate of 1s. per acre, with a minimum of 2s. 6d. The new rate is 1s. per acre, with a minimum of 5s. and with an exemption for orchards of less than 120 trees. This will mean that owners of small orchards will not have to pay the tax at all. As a matter of fact, the half-crowns they paid under the old Act were almost swallowed up by the expense of collecting and accounting for them. As hitherto, the net proceeds of the general orchard-tax will be paid over to the New Zealand Fruitgrowers' Federation, for such purposes in furtherance of the interests of the fruitgrowers of the Dominion as may be approved by the Minister of Agriculture.

The special orchard-tax will operate only in those gazetted commercial fruitgrowing districts in which the Minister of Agriculture decides that it should be levied, and it must not exceed 5s. per acre. The net proceeds will be handed over to the Fireblight Committee of the district for expenditure in connection with the control of fireblight, including the cutting-down of hawthorn hedges, which are one of the chief means of spreading the disease, and which, in commercial fruitgrowing districts, have to be cut down in compliance with the Fireblight Act, 1922.

FUNGICIDES AND INSECTICIDES ACT, 1927.

The purpose of this Act is to give a measure of control over the composition of oils and chemicals sold for use in combating diseases of orchards and field crops, or for use as weed-killers. It has nothing to do with insecticides for the protection of human beings, nor with dipping-materials for cattle or sheep. The Act makes it an offence to sell any fungicide, insecticide, or weed-killer not up to the standard prescribed by regulations under the Act. The materials to which it will apply will therefore depend to a large extent upon the regulations that will be made after consultation with those interested. The Act, further, prohibits the sale of any fungicide, insecticide, or weed-killer bearing any false or misleading description.

INTRODUCTION OF PLANTS ACT, 1927.

There has hitherto been no legislation controlling the importation into New Zealand of plants not affected by disease, and it has consequently been open to any one to import plants that might later on spread and become serious pests. It is, of course, not advisable to control the importation of ordinary plants of kinds that are already commonly grown in or imported into the Dominion, nor practicable to regulate what might be called the accidental introduction of plant pests by such channels as ships' ballast, seeds in packing-material, or impurities in useful seeds imported; nevertheless it was felt that steps should be taken to control the intentional introduction of new plants into the Dominion, and this Act was passed for that purpose.

The general purport of the legislation is to prohibit the importation of (*a*) any plant included in any of the schedules of the Noxious Weeds Act, 1908, or (*b*) water-hyacinth or any other plant named for that purpose by Order in Council; and to provide that any person desiring to import any plant which, or any variety of which, is not commonly grown in or imported into New Zealand shall first obtain a written permit from the Minister of Agriculture. Had this Act been in force in the past, the introduction of such pests as blackberry and gorse might possibly have been prevented or delayed. Moreover, there are growing in other countries other highly undesirable plants which misguided persons might still wish to introduce into New Zealand, a procedure that can now be prevented if the law is adhered to.

It should be noted that no permit is required in the case of any new variety of such plants as apples, potatoes, wheats, roses, or chrysanthemums, seeing that other varieties of these are commonly grown in the Dominion. The Act is only applicable to plants, including seeds, in a state in which they are capable of growth. The Act also provides that if prohibited plants, or plants for which a permit is required, are received without having been ordered, they must be burnt, or a permit obtained, as the case may be.

SECTION 38 OF FINANCE ACT, 1927 (NO. 2).

This is merely a "machinery" enactment to authorize the Fruit Control Board to pay to the Fruitgrowers' Federation, as agent for the owners of fruit exported, moneys due by the Board to such owners under paragraphs (*d*) and (*f*) of section 30 of the Fruit Control Act, 1924.

STOCK AMENDMENT ACT, 1927.

This Act, as finally passed, deals with the three undermentioned matters only :—

(1) It repeals section 56 of the Stock Act, 1908, which section contained the law in regard to the recovery of stray live-stock, and substitutes provisions to the following effect : When an owner believes that any of his stock are in the possession of another person, or on such person's land, he may apply to an Inspector of Stock, and the latter may require the stock of such other person to be mustered on a given date for the purpose of handing over any belonging to the owner making the application. In the absence of the Inspector a constable may order the detention for not more than seven days of stock whose identity is in question. The Inspector, on application by the person receiving the notice, may postpone the time fixed for the muster. The person receiving the notice to muster, or order to detain, is entitled to recover expenses and compensation for damage from the owner making the application.

(2) It repeals section 4 of the Stock Amendment Act, 1913, dealing with registration of brands or marks used by stock-breeders' associations, and makes provision as follows : On the application of a breed society, testing association, or other society for the improvement of stock, the Director-General of the Department of Agriculture may register a standard mark to be used by such society to indicate that stock do or do not comply with its standards or tests. Any society eligible to register a standard mark may, with the Department's consent, brand animals under test so as to permanently identify each animal with the record of its tests. The use of any system by more than one owner for marking stock to indicate merit or test, unless the Department's consent to such system has been obtained, is prohibited.

(3) It provides that any person who with dog or gun goes on any private land without the occupier's authority and disturbs any stock depastured thereon may be fined up to £5 on the information of the occupier. This is a simpler means than existed previously for dealing with the disturbance of stock by trespassers with dog or gun ; but occupiers of land should note that they must themselves lay the information, and that it is necessary to prove that the stock were actually disturbed.

SLAUGHTERING AND INSPECTION AMENDMENT ACT, 1927.

This Act provides (1) that local authorities controlling slaughtering establishments may raise loans for additions to or reconstructions of existing or future public abattoirs without taking polls of the ratepayers on the subject, and (2) that meat slaughtered at the abattoir of one local authority and sold in the district of another local authority shall be liable to the payment of certain fees to the latter authority.

With regard to the first of these matters, the original Slaughtering and Inspection Act of 1900 made provision for the establishment of abattoirs—being a matter directly affecting the public health—to be carried out by means of a loan without a poll of the ratepayers ; but that Act omitted to make the same provision in regard to additions or reconstructions that would become necessary as time went on, and as the same reason applies—the public health—this omission has now been rectified.

The reason for the second part of this Act is that certain local authorities are obliged by law to make provision for public abattoirs for their districts, and it is therefore but reasonable that fees to provide for the overhead expenses of the abattoir should be paid on all meat sold in the district, even if the butcher selling the meat finds it advisable to have it slaughtered in the public abattoir of another district. The fees payable in such cases will, however, not cover the cost of the actual slaughtering and dressing of the meat.

APIARIES ACT, 1927.

This takes the place of the Apiaries Act of 1908 and the amending Acts of 1913 and 1920, and makes the following alterations in the law as embodied in those measures :—

(1) At present registration of apiaries is required in every third year. This is costly in clerical work and postage, and is somewhat of an annoyance to beekeepers. Under the new Act registration is intended to remain operative as long as the same beekeeper occupies the same premises and continues to keep bees thereon.

(2) Instances have occurred in which diseases (especially foul-brood) have been brought into clean districts owing to the removal of apiaries from unclean districts. This nullifies the considerable expenditure the Department of Agriculture is incurring in an effort to clear the country of bee diseases district by district. To meet this, it is provided in the Act that no beekeeper shall remove bees (unless they are sold) or used appliances for a greater distance than 10 chains without a permit from an Inspector. Arrangements will be made to grant in suitable cases permits to individual beekeepers covering the removal of their "out" apiaries throughout the season, so as not to cause unnecessary inconvenience.

(3) The Act provides for the condemnation of honey unfit for human consumption from any cause, and for the treatment or destruction of honey if there is reason to suppose that it is poisonous.

Wool-branding Fluids.—In his annual report for 1926–27 the Chief Chemist to the Department states: "Complaints having been made by woollen-manufacturers that preparations were in use for branding which were not removable by the usual scouring processes, samples of the branding-fluids on the market and of branded wool were submitted for examination. Several of the wool-samples contained coal-tar, but it was not found that this substance was an ingredient of any of the commercial fluids examined. Other samples of wool were found to contain thick masses of pigment that could only be removed by prolonged scouring or by a brief preliminary treatment with a suitable solvent. In such cases it would appear that the trouble complained of is the result of failure to keep the branding-fluid stirred while in use, resulting in some of the fleeces receiving a heavy brand of thick pigment from the bottom of the can. The investigation is being continued."

Actinomycosis.—The number of cases of this disease dealt with by the Live-stock Division throughout the Dominion in the year 1926–27 was 689, a decrease of sixty-five on the previous year. The cases were distributed as follows: Otago-Southland, 77; Canterbury-West Coast, 57; Wellington, 208; Auckland, 347. All live-stock inspection districts, with the exception of Otago-Southland, which shows an increase of twenty-four, shared in the decrease. Medicinal treatment is advised for this disease when detected in the early stages; as a result of such practice many animals have been saved from condemnation.

MINERAL CONTENT OF PASTURES.

PROGRESS OF THE NEW ZEALAND INVESTIGATION.

B. C. Aston, F.N.Z.Inst., Chief Chemist, Department of Agriculture.

The investigation into the mineral content of pastures in New Zealand has gone steadily forward during the past year, being confined to those areas where deficiency disease due to pasture was definitely known to exist. The analyses of a series of red-clover samples are presented in this article, with a discussion as to the direction in which the results throw light. It is satisfactory to learn that the general conclusions reached several years ago as to the iron-deficiency in the pasture are borne out by the results of these analyses.

With regard to the occurrence of iron-starvation in countries other than New Zealand affecting animals whose sole diet is natural pasture, it is satisfactory to learn that the authorities in those countries are confirming our experience in the treatment of the disease. It was predicted in 1924 ("Transactions of the New Zealand Institute," Vol. 55, p. 723) that the "pining" disease of sheep in the Cheviot district, Scotland, the "coasty disease" of Tasmania, and the "nakuruitis" disease of cattle in Nairobi, British East Africa, would prove to be the same This is now becoming verified. In the *Australian Veterinary Journal* for September, 1927, C. G. Dickinson, B.V.Sc., discusses "coasty disease" and finds that it yields to the same treatment as does "bush sickness"—the administration of iron and ammonium citrate. Mr. R. E. R. Grimmett reports from the Rowett Institute, Aberdeen, that the "pining" of sheep in Scotland is almost identical with the pining of sheep and cattle in certain parts of Auckland Province. He states that the citrate of ammonium and iron lick prescribed by the writer for the cure of affected stock is now being used on pining sheep in the Cheviots with excellent results, and is effecting rapid improvements. Mr. Grimmett further reports that the soil upon which pining develops in North Britain is of the same texture as our Mamaku soil—a sandy silt. The writer also learns that the nakuruitis disease in Nairobi, occurring on a soil derived from a light-grey volcanic ash, is similarly yielding to the medicinal treatment with iron ammonium citrate.

Methods of Investigation.

The composition of a fodder plant is influenced by three classes of facts (Warrington)—namely, those relating to (*a*) the age of a plant, or to the relative development of the parts, leaves, stems, fruit, &c.; (*b*) the composition and physical condition of the soil in which the plant grows, which includes consideration of the manuring and the climate; (*c*) the specific distinctness or the botanical relationship to other plants.

It is therefore desirable in studying the mineral composition of pasture to consider the effect of one varying condition at a time, the other conditions being as far as possible kept constant. Accordingly, in the following account, in an endeavour to arrive at the truth, the inquiry has been limited to three species of plants growing upon three or four types of soil in the same county on both manured and unmanured ground. The stage of growth has been limited to what is

known as well-grazed good cow-pasture, and the samples have as far as possible been taken throughout the whole year. The samples have been carefully selected by Mr. Grimmett or by the writer. They were cleaned of any sandy matter by quickly washing in water, a proceeding which may have resulted in loss of potash and soda, but these were not in any case estimated, and the error from washing in the constituents estimated is probably negligible. After drying, the samples were sent to the Department's Chemical Laboratory at Wellington, where they were carefully picked over, neglecting woody stalks and any material foreign to the species being analysed. In this way it is hoped that the botanical purity may be guaranteed, but that freedom from earthy contamination can be definitely assumed is more than can be hoped. In some cases earthy impurity seemed to adhere so tenaciously to the leaves that it could not be eliminated by washing. After air-drying, the samples were dried in the hot-water oven to a brittle state which enabled the portions to be broken in the hands to a state fine enough for 10 to 20 gram portions to be weighed with every probability of obtaining a fair sample.

In analysing samples of fodder plants it is desirable to establish the presumption that a sample is pure and free from such contamination of earthy particles as would appreciably affect the results of any analysis for mineral foods it is sought to estimate. This precaution is especially necessary in the case of elements such as iron and manganese, which exist to a much greater proportion in the soil than they do in the tissues of the pasture plant which lives on that soil. It is probable that ruminants cannot assimilate such mineral foods when they are present as earthy contamination. Such minerals, it is thought, must first be absorbed and be present in the tissues of the plant before the animal can absorb them.* Iron, for instance, may exist in amounts about 1 per cent. in a pumice soil, and is extracted by the hydrochloric acid used in dissolving the plant ash. The amount of iron (Fe) present in the tissues of dried grass is about 0.01 per cent., or one-hundredth of what it is in the soil. It will be easily seen that a very small contamination of the grass with soil will make a very large error in the estimation when the grass ash is analysed. Half a gram of pumice in one hundred grams of dried grass will therefore contribute as large an amount of iron as 0.005 per cent. to the assay, an amount as large as the grass tissue may itself contain, involving an error which therefore doubles the true iron content.

In order, therefore, to guard against the effect of an impurity which all the precautions taken in sampling have not been able to exclude, the results of analysis have been classified into "contaminated" and "uncontaminated" samples. In the contaminated samples the amounts of iron and of manganese have been given, but these determinations are not to be accepted as representing the natural ash of the plant. On the other hand, the determination of phosphoric acid and lime occurring naturally in pumice soils is so small that contamination does not contribute an error which will swamp general conclusions, and these may therefore safely be drawn from those determinations of samples contaminated by earth.

* Experiments with salts of iron in combination with mineral acids alone suggest that these are not so assimilable as those in organic combination.

In ascertaining from analysis what samples are and what are not contaminated, the writer makes use of two facts—the content of silica and the content of alumina. Silica is absorbed by grasses to a much larger extent than by clovers, so that a different standard is required for each class of pasture plant. When the amount of silica is greater than a certain amount it is valuable evidence of pasture contamination by earthy siliceous matters. The estimation of alumina is especially valuable as a method of determining the purity of a pasture sample. Aluminium always accompanies iron in New Zealand soils, but it is absorbed by the higher plants—to which the fodders belong—only in very small traces. Hence, if more than traces of aluminium are found in a solution of the ash of a pasture plant one may conclude that it is contaminated by earthy matter, and that the iron determination should be disregarded as probably much too high. Probably also the manganese determination will be in error from the same cause.* As to the manner of stating the results, and the methods used in analysis, the calculations are all stated as percentages of the constituent, calculated on the sample dried in the water oven until the loss on reheating was inappreciable. The method is in conformity with that used by research workers in other parts of the world, and in the writer's opinion is justified by his experience. The methods of analysis used are official or have stood the test of long experience in the writer's laboratory, and where any method was used other than that sanctioned by official publications it was checked by official methods by another operator.

Attention may again be drawn to the difficulty of obtaining a representative portion for analysis when dry grass or clover tissues of low specific gravity are contaminated with sandy or earthy material of much higher specific gravity. Contaminated samples must therefore be very carefully sampled, and in such cases check assays always made on duplicate weighed portions.

Notes on Results of the Analyses.

The aim in analysing the samples of pasture components was to obtain representative portions of the most commonly occurring plant staples in that condition in which they were actually being consumed by the ruminant. For the present the results reported only refer to cocksfoot-grass, red clover, and white clover. It is hoped to extend the work in the future to other species, to pastures as a whole, and to inorganic constituents other than those upon which the work has hitherto been done.

It should be premised that bush sickness does not in Rotorua County occur on land the topsoil of which is finer than a sandy loam; further, that although the practice of applying fertilizers, the nearness of the water-table to the surface, the packing of soil particles by running or lake water, and the admixture of "humus" may convert a coarse pumice soil to a healthy one for stock, it will be well to regard all soil-types mentioned herein as suspicious except the external districts' samples and the sandy loams of those from Oturoa and Te Ngae. Another type of fine soil occurring in the Rotorua district is the silt

* This method was first used by the writer in investigating mortality in lambs in Central Otago. See this *Journal* for April, 1927.

Table 1.—Analyses of Red Clovers, Uncontaminated and Unmanured.

Laboratory No.	Locality.	Date.	Ash.	CO_2.	SiO_2.	Fe_2O_3.	P_2O_5.	CaO.	MgO.	Mn_3O_4.	N.	Al_2O_3.	Remarks.
						Kapakapa, Mamaku, and Ngongotaha Mountain.							
T 1042	Mamaku	10/2/26	9·26	1·85	0·10	0·014	0·69	2·04	0·67	0·012	3·63	0·020	200-acre paddock.
W 851	Kapakapa Road ..	9/11/26	10·67	2·12	0·10	0·012	0·80	1·77	0·75	0·011	4·20	0·020	Highest part of road.
W 1202	,, ..	20/1/27	9·50	2·06	0·10	0·011	0·67	2·03	..	0·012	3·54	0·018	
W 1002	Ngongotaha Mountain	29/11/26	8·60	1·77	0·12	0·008	0·48	1·75	0·60	0·010	2·89	0·026	Summit of mountain.
W 1047	Kapakapa Road ..	14/12/26	8·61	1·97	0·09	0·010	0·58	1·87	0·65	0·010	3·23	0·010	
W 1196	Mamaku	12/1/27	9·31	1·97	0·11	0·009	0·62	1·71	0·81	0·015	3·23	0·019	
W 34	Ngongotaha ..	30/3/26	9·59	2·03	0·13	0·011	0·56	2·32	..	0·016	3·28	0·029	Hillside in bracken.
	Average ..	..	9·40	1·97	0·11	0·011	0·63	1·92	0·70	0·012	3·43	0·020	
						Ngongotaha.							
W 843	Streamside ..	3/11/26	9·99	1·82	0·14	0·016	0·93	2·08	0·71	0·010	4·67	0·019	Wet land.
W 1036	,, ...	10/12/26	8·92	1·86	0·20	0·016	0·72	2·31	0·91	0·008	3·33	0·025	
W 1300	,, ..	14/1/27	7·79	1·63	0·19	0·015	0·54	1·60	0·64	0·007	3·96	0·031	In flower.
	Average ..	..	8·90	1·77	0·18	0·016	0·73	1·99	0·75	0·008	3·98	0·025	
						Oturoa.							
W 1033	Muir's farm ..	10/12/26	9·69	2·06	0·15	0·010	0·58	1·82	0·61	0·017	2·96	0·023	
W 1303	,, ..	14/1/27	10·03	2·16	0·13	0·008	0·52	2·26	0·58	0·012	2·96	0·022	
W 246	,, ..	22/6/26	8·99	1·34	..	0·023	0·81	1·62	0·46	0·015	..	..	Three-year-old burn.
W 408	,, ..	22/7/26	10·01	1·08	0·18	0·016	1·05	1·34	0·69	0·016	..	..	
	Average ..	..	9·68	1·66	0·15	0·014	0·74	1·76	0·59	0·015	..	..	
						Te Ngae.							
2004	Gee's farm ..	7/4/27	10·69	1·84	0·21	0·021	0·88	2·01	0·70	0·012	4·74	0·030	

Table 2.—Analyses of Red Clovers, Contaminated and Unmanured.

Laboratory No.	Locality.	Date.	Ash.	CO_2.	SiO_2.	Fe_2O_3.	P_2O_5.	CaO.	MgO.	Mn_3O_4.	N.	Al_2O_3.	Remarks.
						Oturoa.							
R 1085	Muir's farm ..	23/2/24	12·03	3·03	0·26	0·026	0·48	2·71	0·75	0·018	2·78	0·038	
W 839	,, ..	3/11/26	12·13	2·36	0·09	0·012	0·89	2·00	0·73	0·016	..	0·051	Elevated situation, growth backward.
	Average ..	..	12·08	2·69	0·18	0·019	0·68	2·35	0·74	0·017	..	0·044	
						Mamaku.							
W 40	Jackson's paddock ..	1/4/26	9·67	2·01	0·19	0·012	0·60	2·28	0·20	0·018	..	0·055	
W 42	200-acre paddock ..	10/4/26	9·47	1·90	0·12	0·013	0·61	2·08	0·77	0·016	3·85	0·070	
W 314	,, ..	22/6/26	..	..	0·26	0·015	0·89	1·25	..	0·014	..	..	
W 357	.. ..	19/7/26	8·33	0·89	0·40	0·022	0·94	1·18	..	0·010	..	..	Unimproved.
W 488	.. ..	18/8/26	8·89	1·15	..	0·013	1·02	1·33	0·41	0·011	..	..	
W 848	.. ..	2/11/26	10·53	1·83	0·22	0·019	0·84	1·90	0·76	0·018	4·33	0·038	
W 1038	.. ..	10/12/26	10·48	2·02	0·30	0·017	0·78	2·29	0·70	0·016	4·51	0·042	
	Average ..	..	9·56	1·63	0·25	0·016	0·81	1·76	0·57	0·015	4·23	0·051	
						Te Ngae.							
W 54	Smith's farm ..	5/4/26	11·48	2·55	0·54	0·028	0·55	3·19	0·63	0·022	..	0·053	
W 316	.. ..	25/6/26	9·09	1·31	0·57	0·022	0·79	1·26	0·71	0·012	..	..	
W 564	Gee's farm ..	28/8/26	10·89	1·68	0·45	0·032	0·98	1·71	..	0·010	4·64	..	
	Average ..	..	10·49	1·85	0·52	0·027	0·77	2·05	0·67	0·015	..	..	
						Kapakapa and Kaharoa.							
W 341	Kapakapa Road ..	8/7/26	8·61	..	0·43	0·013	0·76	1·05	..	0·011	..	..	
W 342	Kaharoa	8/7/26	9·04	0·95	0·83	0·040	0·72	1·64	1·13	0·026	..	..	Brain's farm.
W 561	Kapakapa Road ..	3/9/26	10·01	1·47	0·28	0·020	0·90	1·43	0·72	0·012	..	0·042	
	Average ..	..	9·22	1·21	0·51	0·024	0·79	1·37	0·93	0·016	..	..	
						Ngongotaha.							
W 311	Lakeside	23/6/26	10·20	..	0·37	0·016	0·78	1·90	0·82	0·034	..	..	Swampy paddock.
W 363	,, ...	23/7/26	9·78	..	..	..	0·81	1·68	0·78	0·035	..	..	
W 484	,, ...	19/8/26	10·95	1·35	0·46	0·021	1·02	1·54	0·80	0·029	..	0·036	
	Average ..	..	10·31	..	0·42	0·019	0·87	1·71	0·80	0·033	..	..	

soil of the Atiamuri Road; no pasture samples have been received from there, but it is known to be healthy country.

RED CLOVERS.

In the *uncomtaminated, unmanured* samples definite evidence is again obtained of the lack of iron in red clover, an important component of pasture on the pumice lands. The amounts of lime, magnesia, and phosphoric acid are fairly uniform in all samples. In the *contaminated* samples, although the iron results must be disregarded, the phosphoric acid, calcium, and magnesium results are valuable evidence. As one would expect, the amount of iron varies as the healthiness of the country; the healthier the country the more iron, the less healthy the less iron, in the samples.

The results of the analyses of white clover and cocksfoot samples will appear in succeeding issues of the *Journal*.

Explanation of Chemical Formulas, &c., in Tables.

"Ash" is the residue obtained on burning the dry matter in a porcelain basin over an Argand burner at the lowest possible temperature, and finishing the combustion in a gas muffle furnace.

CO_2 is the amount of carbon dioxide (carbonic acid gas) obtained on boiling the ash with dilute hydrochloric acid and absorbing the dried gas in soda lime.

SiO_2 is the total silicon dioxide (silica) obtained by dissolving the ash in hydrochloric acid, evaporating to dryness repeatedly, and separating by filtration.

Fe_2O_3 is the total amount of ferric sesquioxide (iron oxide) estimated by two methods.

P_2O_5 is the total phosphoric anhydride (anhydrous phosphoric acid) estimated by two methods.

CaO is the total amount of calcic oxide (lime).

MgO is the total amount of magnesic oxide (magnesia).

Mn_3O_4 is the total amount of manganoso manganic oxide (manganese oxide).

N is the total amount of nitrogen.

Al_2O_3 is the total amount of aluminium sesquioxide (alumina).

The words "manured" and "unmanured" are used to designate samples from land which has not been dressed with artificial fertilizers. In the classification of samples one cannot guard against the possibility of the samples having been manured by stock-droppings.

(To be continued.)

Poultry-farming.—Referring in his last annual report to the census of poultry in New Zealand the Chief Poultry Instructor (Mr. F. C. Brown) remarks: "The most gratifying feature in the returns is the increased number of people keeping large flocks, or, in other words, sufficient to provide the whole or greater part of a livelihood. In 1921 ninety-six people kept flocks ranging from 500 to 900, and forty-one kept 1,000 and over, whilst in 1926 there were 148 and sixty-six respectively. With the advanced knowledge now available relative to the breeding and management of large flocks, an extension of large plants may be looked forward to with confidence."

Tree-planting Companies.—Last year's annual report of the State Forest Service states that the boom in the formation of private and public tree-planting companies and syndicates, which commenced definitely in 1923, reached its climax in 1925, and only three new companies were formed during 1926. Of the thirty-six private and public companies registered in New Zealand, eighteen continued or commenced planting operations during the year, and established 51,242 acres in new plantations. Of this area, 50,937 acres were planted in the North Island and 305 acres in the South Island, bringing the total area planted to date to approximately 70,000 acres.

NAURU AND OCEAN ISLANDS PHOSPHATE.

THE INDUSTRY AND ITS FUTURE.

ALBERT F. ELLIS, C.M.G., New Zealand Commissioner, British Phosphate Commission.

THE steadily increasing exports of dairy and other agricultural and pastoral produce from New Zealand, with the consequent drain on the phosphate contents of our soils, is a subject which calls for careful consideration. We are in effect sending overseas each year thousands of tons of phosphoric acid, probably the most necessary constituent of soils in general, and one in which they are naturally low in most localities throughout this country. Not only must this phosphoric acid be replaced, but our "reverted" lands call for pressing attention, the large areas of second- and third-class lands have to be brought into productivity, the policy of closer settlement and therefore more intensive farming has to be further developed, and our large areas of sheep-country must be top-dressed. This all points to an ever-increasing demand for phosphates.

A few years ago the fact that New Zealand was not taking the quota provided for in the Nauru Agreement occasioned considerable concern, and the British Phosphate Commissioners had to seek outside markets to absorb the surplus production from Nauru and Ocean Islands. But the position is very different now, and the difficulty to be faced is how to cope with the ever-increasing demands of our Dominion and Australia.

During the last few years the consumption of high-grade phosphate in New Zealand has shown a progressive annual increase of well over 10 per cent. If this percentage of progressive increase continues—and from all appearances it will—the quantities which will be required in a few years run into very big figures. In Australia the rate of increase has also been rapid, and is expected to continue; in Western Australia it has gone ahead by leaps and bounds. There is reason to think that in a few years the two countries will be requiring over a million tons of high-grade phosphate per annum.

Already their requirements have exceeded the capacity of Nauru and Ocean Islands, and the question may well be asked as to the reason for this, seeing that the deposits there consist of about a hundred million tons. The actual position may be illustrated by imagining a number of thirsty individuals crowding round a large glass demijohn fitted with a very small mouth and containing water or perhaps something stronger. They want the liquid much faster than it can be poured out, but they have to be careful or the demijohn will get broken and its precious contents be lost.

Nauru and Ocean Islands, by reason of their very isolated and exposed position—without harbours or even anchorages, and subject at times to prolonged spells of bad weather—necessarily have their limitations. It is one thing to develop and carry on a great industry on the mainland, but quite a different matter to do it on two lonely islands in the centre of the Pacific, where problems have to be faced peculiar to the locality and the existing conditions. To unduly

augment the number of vessels arriving there, or to largely increase the labour force before such increase could be suitably employed, would speedily cause complications, bringing about results the opposite of what are desired.

At the present time the capacity of the two islands is about 550,000 tons per annum—though last year the 600,000-ton mark was almost reached—an equivalent of nearly one hundred large steamer cargoes. Particularly fine weather was experienced throughout last year, and there was a minimum of labour and other difficulties. For the previous year, when adverse conditions were encountered, the output was nearly 200,000 tons less, affording good evidence as to how the industry is affected by circumstances beyond human control.

The policy now being pursued by the Commissioners, with the full knowledge and approval of the three partner Governments, is to extend the shipping arrangements at both islands, introducing mechanical handling as far as possible, and also to develop the other plant to keep pace with the improved shipping facilities.

At Nauru a cantilever suited to the special conditions prevailing there is to be erected; it is anticipated that by means of a system of rubber-belt conveyors, which will take the phosphate from the shore bin to the end of the cantilever and discharge direct into the vessel's hold, it will be possible to load a 6,000-ton steamer in a day. This necessitates a great deal of plant development in the way of storage bins, artificial driers, cableways, Diesel engines for supplying power, tram-line extensions, further housing accommodation for the largely increased number of labourers, and so forth. A considerable number of men are now engaged on the preliminary work in connection with the cantilever, but two to three years' time will be required before the plant is ready for use.

At Ocean Island an improved steel jetty of the existing type is being installed, and the storage, drying, and other production plant is to be correspondingly increased. To do all this development work on the two islands, and at the same time maintain intensive shipments, constitutes a very busy programme.

During the next three years New Zealand and Australia between them will require 100,000 to 200,000 tons more phosphate annually than Nauru and Ocean Islands can supply, and this deficit is being purchased by the Commissioners, on behalf of the manufacturers in the two countries, from the French island of Makatea, near Tahiti, and also from Morocco. The huge deposits in the latter country have been coming into increasing prominence during the last few years. Though the quality of these two phosphates is lower and the price is higher than that of Nauru and Ocean Islands, the much larger proportion used from the two latter evens up the business without materially affecting the price or the quality of the whole. The fact that the manufacturers have been able to maintain the high standard of the prepared fertilizers is very satisfactory; in a country where transport and handling expenses are heavy, material economy is effected by dealing with a highly concentrated article. In addition to purchasing these outside phosphates—which is being done for some years ahead—the Commissioners are endeavouring, and with some degree of success, to obtain options over further quantities, to be

exercised in the event of weather or other circumstances beyond control materially affecting the output from Nauru and Ocean Islands.

In all probability the benefit from the new plant installations at Nauru and Ocean Islands will be felt within two or three years, and ultimately it is hoped to work the output from there up to a million tons per annum under ordinary favourable conditions. In view of the natural difficulties to be encountered this objective must be considered a high one, and it may be mentioned that in the early days of the phosphate industry in the Pacific the objective set by the principal company then operating was 10,000 tons per annum, but even that figure was never reached.

Shipments of Phosphate by British Phosphate Commission to Australia and New Zealand since Business came under Government Ownership.

Year ended 30th June,	Australia.				New Zealand.				Total for Australia and New Zealand.
	Nauru Ocean Phosphate.	Outside Phosphate.	Total.	Per-centage.	Nauru/Ocean Phosphate.	Outside Phosphate.	Total.	Per-centage.	
	Tons.	Tons.	Tons.		Tons.	Tons.	Tons.		Tons.
1920–21 ..	265,914	..	265,914	93·96	17,100	..	17,100	6·04	283,014
1921–22 ..	171,286	..	171,286	81·65	38,500	..	38,500	18·35	209,786
1922–23 ..	203,446	..	203,446	79·78	51,550	..	51,550	20·22	254,996
1923–24 ..	320,031	..	320,031	84·02	60,850	..	60,850	15·98	380,881
1924–25 ..	337,298	..	337,298	77·34	98,790	..	98,790	22·66	436,088
1925–26 ..	273,511	53,510	327,021	73·66	97,960	18,977	116,937	26·34	443,958
1926–27 ..	463,090	76,966	540,056	78·45	130,250	18,100	148,350	21·55	688,406
Total, 7 years	2,034,576	130,476	2,165,052	80·27	495,000	37,077	532,077	19·73	2,697,129

The accompanying table sets out the shipments to Australia and New Zealand since the business came under Government ownership, and the rapid annual increases for the Dominion will be noted. Our manufacturers' requisitions for the current year are nearly 180,000 tons; and for 1928–29 there is another large increase, the quantity requisitioned being about 230,000 tons.

The approximate distribution of the last-named quantity is of interest. About 140,000 tons are requisitioned for Auckland, and about 25,000 tons each to New Plymouth, Wanganui, and Lyttelton, tapering down to a comparatively small requisition for farther south. The southern farmers consider this is evidence as to where the good land is situated, but their northern friends hold it is proof as to where the good farmers are!

Opossums and the Forest.—The generally held opinion that the opossum does little or no damage to the native bush is supported by the investigations recently made on beech forests for the Forestry Department by Dr. L. Cockayne, F.R.S., who has a comprehensive knowledge of the forests before and after the introduction of the opossum.

THE FEEDING OF LIVE-STOCK.

J. McLINDEN, M.R.C.V.S., N.D.A., Officer in Charge, Animal Husbandry Branch, Live-stock Division.

I. NUTRIENTS AND THEIR FUNCTIONS.

IN order to further supplement the educational work of the Live-stock Division a connected series of articles on the principles underlying the feeding of live-stock will appear in this *Journal*. No methods will be given showing a simple, easy way to success. The object aimed at is rather to indicate the necessary care and attention required from the farmer if he is to be really successful in obtaining the greatest returns with maintenance of health of the stock. By making clear the principles of feeding, those interested will be placed in a position to understand the requirements of their stock, and from the farming peculiarities of their own district how best to provide for them. It may occasionally be necessary to introduce simple rations as examples, but these must not be regarded as hard-and-fast diets and quantities. Any rations suggested will be based on averages of value to stock, and are to be taken only as a guide. Efficient though they may be, they must be fed, if used at all, according to the individuality of the stock receiving them. It is not intended, of course, to give elaborate rations of concentrated feeding-stuffs. Technical detail generally will be avoided as much as possible.

The whole endeavour of the farmer to-day is to produce, and to breed with that object in view. It is impossible to dissociate these two things—breeding and feeding. When animals are bred up to heavy production they must be fed in proportion to their capabilities. In order to exhibit their abilities the best of milk-producers require the feed to convert into milk. The same principle applies to pigs. No matter from how economical a strain they may be they will never fatten if not adequately fed. Domesticated farm-stock are living machines, converting vegetable materials (chiefly) into food suitable for human consumption. The more they are expected to give, the more and richer the crude products fed to them must be. Farm-stock convert food unsuitable for human consumption into suitable food.

Just as a particular engine requires a particular type of fuel—coal, petrol, or oil—so do live-stock require their particular type of food or fuel if health and function are to be maintained. This food is composed of two substances known as the carbohydrates—such as sugar, starch, fibre, &c.—and fats or oils. These substances form the energy-making part of a food. Although these materials are to be found in all farm crops—roots, tubers, and cereals—they exist in varying quantities. For example, the mangold shows a high sugar content, the potato and maize a high starch content, and hay a comparatively high fibre content. But the carbohydrates and fats do not account for everything required by the animal. The replacement of muscle waste is dependent upon other materials known as the proteins (sometimes called albuminoids or flesh-formers) — the white of egg, for example. Proteins are to be found in all plants in

varying quantities, but chiefly in clovers, lucerne, and other legumes Young grass contains a group of materials which for feeding purposes are grouped with the proteins. They are found in great quantity in young grass, and it is due to their action that this feed is so laxative.

The value of a feeding-stuff depends on the amount of nourishment which the animal is capable of digesting out of it. In practice that means that the farmer must have a rough idea how much value (no matter what quantity may be fed) any food will have to the animal. A great quantity of bulky food might be of less value than a few handfuls of oats. All the compounds found in feeding-stuffs need not be of value to the animal consuming them. Those constituents which may be of value are referred to as nutrients, and a nutrient may be defined as any constituent, or group of constituents, found in food-stuffs that may aid in the support of animal life. As already indicated, these groups are at present known as the carbohydrates, fats or oils, proteins, ash, and water. It is frequently convenient to group all these materials (except the water) together, when they are referred to as the dry matter. Two other materials—the vitamins and the pigments—must be mentioned, especially the former, because of the prominence which it is being given.

Nutrients considered.

Water.

Water is one of the most important component parts of all feeding stuffs. It varies considerably in amount; it may be as low as 5 per cent. in the concentrates (meals and cakes) and as high as 90 per cent. in roots. Water is absolutely essential to the animal; it performs more obvious functions than anything else. No matter of what origin, either as a food-constituent or as a drink, it aids the process of digestion, absorption, and transportation of nutrients, the elimination of undigested material in the dung, the elimination of waste products from the body as urine, and the production of milk in the female. Cow's milk contains 87 per cent. of water.

It is for this reason that roots such as turnips, mangolds, pasture, and silage prove so beneficial to dairy stock, which, more than probably, are being deprived of their full allowance of water. No doubt each food might have its own particular merit, but these would be very limited if water was withheld or curtailed. Great discussions are always readily started on this subject, especially when a comparison is being made between the value to the animal of plant-juices and good drinking-water. It would be absurd to ignore the value of plant-juices, but it would be much worse to ignore the necessity of a plentiful supply of a good wholesome drinking-water. Stock not provided for in this way always respond remarkably well once a good supply is installed. A good supply of water should exist in every paddock or shed holding stock.

Carbohydrates.

The carbohydrates constitute a very large group of compounds, and for feeding purposes they have been divided into two—the soluble carbohydrates, such as the starches and sugars, and the crude

fibre. They are stored in large quantities in all roots, tubers, and cereals, and, except the crude fibre, they are as a rule readily digestible by all farm-animals.

The soluble carbohydrates are all very similar. Starch is found most commonly in farm feeding-stuffs; in cereal grains it constitutes 60 to 70 per cent. of the soluble carbohydrates. Sugar is abundant in roots such as mangolds. In root crops the starches and sugars are found to vary considerably in quantity, from about 6 per cent. in turnips to 20 per cent. in sugar beets.

The crude fibre is the woody or stringy part of a plant. This material also varies greatly in its percentage in different feeds. In fish-meal it is absent, in roots it is very low, while in hay and straw it becomes high. Oat straw contains 34 per cent., rye-grass 30 per cent., brown hay ensilage 23·5 per cent. This will show that even in the roughages or fodders it varies greatly. Among the grains, oats possess 10·3 per cent., barley 4·5 per cent., maize 2·2 per cent., and maize as silage 5·7 per cent.

The soluble carbohydrates, and to a degree the crude fibre (in the case of ruminants), are converted by the animal body into heat and energy. The amounts of these substances digested and absorbed, but not required for maintenance, &c. (surplus to the demands for heat and energy), are converted into fat and stored in the body for any future emergency. In the case of the dairy cow these substances are converted into milk-fat and sugar, although they have no direct influence on the yield or composition of the milk, what is not required for milk-production being converted into fat, just as with other animals.

In the case of the dairy cow the crude fibre has another important function—the addition of bulk to the food. The digestive system of the dairy cow and the sheep and goat is highly organized to cope with this type of food with a far greater efficiency than that of other farm stock. But the important point is the added bulk, which is specially suited to the digestive requirements of ruminant stock. Pigs, on the other hand, owing to their particular type of digestive system, and also the age at which they are fattened, must not be fed on such materials. Though beneficial to the cow and sheep, it would be disastrous if given in the same way to pigs. Chaff, for instance, is not suitable for pig-feeding, although it is quite suitable for horses, sheep, and cattle.

Fats.

Fats are present in all farm fodders and grains in varying quantities. Carrots possess 0·2 per cent., mangolds 0·1 per cent., pasture 0·8 per cent., barley 1·5 per cent., and oats 4·8 per cent. What frequently is described as the artificial or concentrated foods contain much more, but these foods are of interest to only a limited number of our farmers. The fats or oils may be described as a concentrated form of heat and energy so far as the animal is concerned. They provide two or three times as much heat as the same quantity of carbohydrate. Their function is similar to that of the carbohydrates; what is not required for immediate use is stored in various parts of the body after being converted into the fat peculiar to the animal which has digested it.

It has just been said that fats are changed or reconstituted in the animal body. At the same time it will be interesting to note their

effect on the butterfat of milk. Fats consumed by the animal do not cause the milk to become richer in butterfat percentage. They may cause a temporary change, but any alteration in diet will act similarly. Their main effect is on the character of the butterfat when made into butter. Some fats cause the butter to be much whiter, some harder, some softer, and some make it decidedly oily. But so long as farm produce or crops alone are used for feeding dairy stock little variation results other than in the colour and to a slight extent in the hardness of the butter.

Proteins.

These are what is popularly known as the flesh-forming part of a food; chemically they are extremely complex substances. As found in plants they are not all alike; they differ from each other just as they do in human food. Farm crops show great differences in their protein content. All the leguminous crops, such as lucerne, clover, peas, and beans, contain the highest, and the green forages (except young growing plants) the lowest. Carrots contain 1·2 per cent., mangolds 1·2 per cent., turnips 1·0 per cent., perennial rye-grass 2·9 per cent., brown hay silage 10·2 per cent., and separated milk 3·5 per cent.

Although the proteins are described as the flesh-formers they may be utilized by the body to produce heat and energy, but at a very great waste. It is not advisable, either from an economic or a health standpoint, to provide more of this type of food than the body requires. Proteins are expensive, and, further, they throw a great strain on the animal system to eliminate what is not required by the body. In many instances their excessive use has caused much trouble and even death among young pigs.

A good supply of protein is very essential for dairy cows in milk. It is necessary for milk-production, and, moreover, stimulates the animal to produce. At the same time it should be borne in mind that the animal must be given a variety of this substance by providing as great a mixture of foodstuffs or grasses as possible. Proteins differ according to their origin, and as it is not known definitely which of them may possibly be curtailed or even neglected it is advisable that as great a variety as possible should be fed. From an animal-nutrition point of view it is essential for all pastures to be composed of as many different grasses as practicable, and for these in turn to be in a healthy and vigorous condition. It must be borne in mind that just as an animal can suffer from malnutrition so can a plant. A grass weak and deficient in food value becomes in time manifest in the stock which eat it. It may not show for several generations, but it will surely do so in the end. If an animal has to live and thrive chiefly on pasture, the greater becomes the necessity for this source of food to be in as wholesome a condition as manuring and management can make it. A certain quantity is essential, but quality is just as essential. A dairy cow, for example, can exist for a considerable time on straw—an extreme case of feeding quantity with little quality. But give that same animal as much as she can consume of good nutritious hay and she will live and produce. Just as there is a difference between straw and hay, so do we find a difference between good, suitably-manured, well-managed pastures and those which receive only the minimum of attention.

Vitamins.

Vitamins are substances about which little will be said here other than that their existence is being investigated. The writer follows the belief that stock find their needs in good mixed pasture. He is also of the opinion that the so-called action of vitamins may some day be proved to be a mineral action, or rather the action of a combination of minerals. At any rate, knowledge of what they are, how they act physiologically, how much the animal system requires of each, their individual action on the body, whether they are stored in the body or not, and so forth, is still far too incomplete to be included here. At the same time it may be noted that specific nutritional peculiarities are observed with certain foodstuffs.

Ash.

Chemists group those materials already described—namely, the carbohydrates, fats, and proteins—as the organic constituents of food, and the ash as the inorganic constituent. Although the ash is composed of a very great number of different compounds it forms a very small portion of the food, but a very necessary portion. The more the mineral requirements of live-stock are studied the more complex does the subject become. The requirements vary according to age, breed, and (strange as it may sound) the quantity of food consumed by the animal. These are only a few of the factors which influence mineral requirements; to that list could be added type of food.

The ash constituents are utilized in the young growing animal body especially for the building-up of the frame, and in the older body for its repair, the development of the fœtus, and in milking animals for all the milk solids. So long as the young animal is being suckled nature provides it with a plentiful supply of minerals in the mother's milk. But how much of these minerals can be assimilated by the young or even the mature animal when added to their food is not yet known.

The most important constituents of the ash from the feeding viewpoint are calcium, phosphorus, sodium, chlorine, and iodine. Iodine, although occurring in comparatively small quantities, is very important; its presence co-ordinates the processes of assimilation, resulting in increased growth. The values of sodium and chlorine are well known by the result of feeding ordinary salt.

Calcium in feeds is generally referred to as lime. It is very unevenly distributed. Bran contains 0·2 per cent., and oats and beans 0·1 per cent.; so it is seen that in these types of feeds lime is relatively low. Pasture grass and oat silage contain 0·4 per cent., mangolds 0·05 per cent., and meadow hay 1 per cent. It needs no further examples to show how the general farm crop is very poor relatively in its lime content.

As for the phosphorus, which is generally expressed as phosphoric acid, it is more evenly distributed. Oat silage has 0·25 per cent., pasture grass 0·15 per cent., mangolds 0·1 per cent., and hay 0·4 per cent.

Where production is the object (and it should always be so) a deficiency in the ash of the food given means that the animal must draw on its own stores. This will last for a period, but will ultimately

lead to reduced production and even disease. From what has been said it will readily be understood why the dairy cow should be well fed during her dry period. This is the farmer's opportunity to enable her to lay up a reserve store of minerals to fall back on during the height of her lactation especially. Failure to do this—to feed well during the dry period—can only result in decreased output. It should also be obvious that the practice of turning dairy cows out on a turnip crop and allowing them to feed there with little or no good clover hay to supplement the roots only means future failure to achieve the maximum from the herd.

The foregoing remarks apply equally to the pig. No doubt the shorter life of the pig does not afford the same opportunity for observing any deficiency, but how great must it be when rickets occur in this animal. Rickets are only a symptom of the deficiency which has occurred—lack of minerals or ash in the diet.

(To be continued.)

PRESERVING FENCE-POSTS WITH CREOSOTE.

In the *Journal* for April, 1925, was published an article by Mr. A. J. Entrican, State Forest Service, dealing with the preservative treatment of fencing-posts. Since that date the Service has slightly revised its practice in some particulars according to later experience. In the creosoting of posts by the open-tank process the following time-schedule of immersion for the various species is now recommended :—

Species.	Butt.		Top.	
	Hot Bath.	Cold Bath.	Hot Bath.	Cold Bath.
	Hours.	Hours.	Hours.	Hours.
Pinus austriaca (Austrian pine), *P. densiflora* (red-pine of Japan), *P. Murrayana* (Murray's pine), *P. rigida* (pitch-pine), *P. strobus* (white-pine)	1	½	Nil	1
Pinus Laricio (Corsican pine), *P. muricata* (prickly-cone pine), *P. ponderosa* (pondosa pine), *P. radiata* (insignis pine), *P. taeda* (loblolly pine), *P. teocote* (twisted-leaf pine)	1	Nil	Nil	1
Eucalypts (all species)	3	1½	1½	1
Poplar and willows	3	2	1½	1
White-birch (*Betula alba*)	2½	1	1½	½
Wattle	5	2½	2	1
Hinau, matai, tawa, tawhero, kamahi, rewarewa	4	2	2	1
Tawari, red-beech	5	2	2	1
Mountain-beech, silver-beech	8	4	3	1

The treatment recommended for the second group of pines is for thoroughly seasoned timber. If any doubt as to seasoning exists they should be given a longer treatment—at least as long as that recommended for the first group of pines.

Other information on the subject is given in a concise form in State Forest Service Leaflet No. 5, from which the table is extracted.

NORTHERN WAIROA EXPERIMENTAL AND DEMONSTRATION FARM.

ESTABLISHMENT AND FIRST TWO YEARS' WORKING.

C. J. Hamblyn, B.Ag., Instructor in Agriculture, Whangarei.

ESTABLISHMENT OF THE FARM.

From the commencement of operations at the Stratford Demonstration Farm in 1917 keen interest was taken in that institution and its working by many of the progressive farmers of the Northern Wairoa district, and at the first winter farm-school held at Dargaville in 1924 the possibility of establishing a local farm to be run on similar lines was discussed with officers of the Department of Agriculture. This led to the setting-up of a committee early in 1925, representative of the farming and business interests of the district, to go fully into the question of acquiring a suitable property. It was desired that the farm should be easily accessible to farmers visiting Dargaville, and that at least two soil-types—river-flats and sandy gum-land—should be represented. River-flats comprise some 20,000 acres along both sides of the Northern Wairoa River, and the sandy gum-land occupies an extensive belt of country between the river and the west coast, as well as isolated areas eastward of the river.

After a careful inspection of several properties offered, the committee decided that the most suitable one in respect of the two features mentioned was a farm of 125 acres at Mangatara, one and a half miles from Dargaville, a portion of the estate of the late Donald Finlayson. The farm comprised 26 acres of the sandy gum-land in weak paspalum, brown-top, and danthonia pasture sown about four years, and 99 acres of river-flat made up of 44 acres in fair rye-grass-cocksfoot pasture, 12 acres in new grass, 9 acres in young paspalum and clovers sown with a crop of millet, 6 acres in cultivation, and the balance of 28 acres (within the borough boundary) in rough-sown swamp. The farm was subdivided into twelve paddocks of various sizes, most of the fences being in bad repair. The main buildings consisted of a good six-roomed kauri house, and an eight-bail walk-through cow-shed with milking-machine and plant complete. The terms offered the committee were a lease of the property for three years at 6 per cent. on the purchase price of £45 per acre, with the right of purchase. Borough and county rates, including rates for borough water laid on, amounted to £90.

On the recommendation of the committee the terms were agreed to, the society known as the Northern Wairoa Experimental and Demonstration Farm Society was formed and duly incorporated, and an executive committee of farmers and business men elected. The rules adopted were practically the same as those of the Stratford Demonstration Farm.

The society commenced with a membership of 134. An application for a Government subsidy of £300 per year for three years was applied for and granted, a loan was raised for the purchase of stock and implements, and a manager was appointed. Farm operations commenced on 1st July, 1925.

First Year's Operations: Season 1925–26.

From the time the property was inspected in March until the Farm Society finally took it over at the beginning of July a great deal of damage was done to the permanent pastures on the flats, first by an invasion of black crickets, which destroyed most of the rye-grass and cocksfoot over large areas of the best paddocks, and later by the heavy stocking of the pastures while they were waterlogged, immediately prior to the clearing sale held by the previous owner at the end of June. As a result one pasture of 12 acres reverted rapidly to a dense growth of rushes, and two young pastures of 12 acres were tramped under and replaced by pennyroyal and buttercup, thus reducing the available grazing by at least half.

FIG. 1. VIEW OVER RIVER-FLAT PORTION OF FARM, SHOWING NEW OPEN DRAINAGE SYSTEM.

THE DAIRY HERD.

It had been originally intended to carry between forty-five and fifty cows, but the number was finally reduced to thirty-two cows and six heifers, purchased at clearing sales. It was recognized that with the drainage conditions then existing on the farm (which the society was not in a position to alter immediately) and with successful supplementary cropping dependent on weather conditions in the spring and early summer any attempt to carry more stock than the number just mentioned would be unsafe. The herd purchased consisted of good average cross-bred animals from tested herds, it being the intention to grade up as rapidly as possible by the use of pedigree Jersey bulls with the requisite butterfat backing.

SUPPLEMENTARY CROPPING.

A system of supplementary cropping was undertaken to supply additional feed from January onwards, and for that purpose 12 acres was sown in various crops as described below. Attempts to increase

the pasture area, so as to provide for hay, by disking and surface-sowing a portion of the area tramped out were not successful, due to the sodden condition of the ground until late October, followed by a sudden drying out in November.

An area of 2 acres of College Algerian oats was sown in the third week in October with 6 lb. of red clover, and fed out in January, after which the red clover provided excellent feeding for another two months. Three acres of green maize was sown in breaks of 1 acre, the first being Ninety-day, followed by two of Hickory King. The inclusion of 1 bushel of partridge peas with the last break considerably improved the feeding-value, the peas coming away well among the maize, which was sown in 14 in. rows, while the peas were cross-drilled through every coulter.

FIG. 2. DEMONSTRATION WITH THE MOLE PLOUGH, TRACTOR-DRAWN.

The gum-land portion of farm lies on terrace in background. Manager's house seen on rise.

The maize lasted until the end of April, when the feeding of 2 acres of chou moellier was started. The chou moellier had to be resown, and it was interesting to note that the first sowing at the beginning of December escaped almost entirely an attack of diamond-back moth grubs and also aphis, while that sown a month later was able to make little headway on account of these pests until the first autumn rains at the beginning of April. Two acres was sown in mangolds, but with the exception of a few rows transplanted in early December the results were poor. The crop was badly attacked in the seedling stage by cut-worms, and owing to the bad drainage conditions the ground could not be sufficiently well prepared for this crop.

Several manurial and variety trials were set at the request of the committee, but the results, as expected, were completely obscured by the unsuitable conditions for the growth of the crops. As already indicated, until the soil conditions are improved by an effective drainage system the successful growing of annual crops on such

land is dependent almost entirely on the weather conditions. The crops grown, however, were sufficient for the purpose, with the exception of the failure of the hay crop and the partial failure of the mangolds, which necessitated the removal of the majority of the stock from the farm for the winter.

PASTURE-IMPROVEMENT.

The top-dressing of 36 acres of pasture was carried out in July and August, and the effect of this treatment was apparent throughout the season. Considerable areas of pennyroyal and buttercup gave way to the improved growth of rye-grass and white clover. The policy with regard to top-dressing on the farm, in order to avoid confusion later, has been to top-dress the whole of each paddock with a straight phosphatic manure. During the first season basic slag and superphosphate were used at the rate of 3 cwt. per acre on separate paddocks, and one paddock of 9 acres received 3 cwt. per acre of Ephos phosphate, following the sowing-down in the previous year of the area with this manure. Until such time as definite trials can be carried out much useful information may be gathered from observation of the growth in the various paddocks, and especially the effect on the cows of a change from one paddock to another.

The general scheme as regards the pastures on the farm, which will be followed as far as possible, is as follows: Firstly, a rapid increase in the proportion of pasture to land under crops, with finally the elimination of all crops, excepting perhaps mangolds and carrots; the top-dressing of the best pastures first, extending the treatment as funds permit to all the permanent grassland; then increasing the amount of top-dressing on the best pastures by two and even three applications each year, together with further subdivision and consequent increased stocking.

Before very much can be done along these lines a considerable improvement must be effected in the drainage of the farm, and with this in view plans and specifications of a main drainage scheme as a basis for future work were drawn up for the society by the Lands and Survey Department. A commencement was made with this work early in the present season.

A further 6 acres of permanent pasture was sown in the autumn of 1926, and preparations were made for the treatment of the 12 acres which had reverted to rushes, with a view to eventually putting it into pasture also.

BUTTERFAT PRODUCTION AND FARM FINANCE.

During the season the original herd of thirty-eight cows and heifers was reduced by various losses to thirty-three. The average factory return of butterfat per cow was 210 lb., a marked reduction on the total butterfat production of the farm for the previous year, which according to the factory returns was 210 lb. per cow from forty-five cows.

As was expected when the farm was taken over, the balance-sheet showed a deficit, this amounting to £287 on the year's working. The prospects of improving the position not being encouraging, negotiations were opened with the trustees of the estate, with the result that the property was finally placed on offer to the society at a cash purchase

price of £32 per acre, with a considerable rebate of outstanding rent still due. At the first annual general meeting of the society held in July, 1926, the position was reviewed, with the result that the newly elected executive committee was instructed to complete negotiations for the purchase and arrange for the necessary finance.

Second Year's Operations: Season 1926-27.

Early in the season negotiations were completed for the purchase of the farm by the society, the change-over from leasehold to freehold being made on 1st December, 1926. At the same time arrangements were made to borrow up to £300 to carry out necessary improvements, chiefly in the way of drainage. Briefly, the position with regard to the farm as it now stands is that the land and buildings are subject to two mortgages, one of £3,000 bearing interest at 6½ per cent., including a sinking fund of 1 per cent., and a second mortgage of £1,000 at 5 per cent. and falling due on 31st December, 1928. In addition, interest has to be paid on the loan as it is lifted for improvements, and the stock and implements are mortgaged to the extent of £500 at 9 per cent.

Owing to the general financial stringency which existed during the past year the society postponed the appeal for funds to assist in wiping out the second mortgage and the chattel mortgage, but there is every indication that the required amount will be raised in the district, so that the farm and stock will virtually belong to the farmers of the Northern Wairoa.

PASTURES.

The work of improving and renewing the permanent pastures was continued during the year. Sixty acres was top-dressed at the rate of 3 cwt. of fertilizer per acre, 4½ tons of superphosphate, 3 tons of basic slag, and 1½ tons of Ephos phosphate being used for this purpose. The policy of top-dressing each paddock with a single fertilizer was continued. So far as can be judged by a careful study of the pasture and the preference shown by the stock basic slag is giving the best results. The effect of the slag is more marked in spring and autumn, when there is plenty of moisture in the soil, whereas the superphosphate tends to show up to advantage during dry weather in February and March. The next advance in the top-dressing will be the alternation of slag with super as the annual top-dressing, followed by double top-dressing with slag in autumn and super in late spring. The effects of the top-dressing have been marked throughout by a rapid improvement in the sward and the crowding-out of pennyroyal and buttercup.

A further area of 6 acres was sown to permanent pasture; an additional 9 acres, in which there was a fair amount of paspalum but which had reverted to a dense growth of rushes, was broken up and cropped with maize preliminary to laying down to permanent grass in the spring after disking.

Altogether the area in pasture has been increased from some 36 acres in the first season to 67 acres, which is available during the current season.

CROPS.

Though it was the original intention to reduce the area under crop the method adopted in dealing with the excessive growth of rushes

on the paddock already mentioned necessitated ploughing and cropping for one season. In order to allow free seeding of the scattered paspalum a crop of cob maize was taken off this paddock, while another 6 acres was used for growing supplementary feed for the herd, and 3 acres for pigs.

The crops for the herd included 2 acres of chou moellier and 2 acres of swedes for late autumn and winter feed, and 3 acres of soft turnips, which were fed out from the end of January until the end of April. In addition, an extra 2 acres of swedes was sown on a portion of the rush-paddock which could not be prepared in time for the maize. This crop, though only sown on 14th January after a rough preparation, did well and lasted well into the spring despite wet winter conditions.

FIG. 3. CHOU MOELLIER CROP FOUR AND A HALF MONTHS AFTER SOWING.

Six acres of cob maize was grown, the variety being Early Butler, which matured well despite late sowing and an exceptionally early frost at the end of April. The crops grown for the pigs included artichokes, partridge peas, and a portion of the soft turnips.

Though no manurial trials and few variety trials were carried out the crops grown were of particular interest to visiting farmers, especially as regards the improvement shown on those of the previous season, mainly on account of the improved drainage conditions.

DRAINAGE.

Considerable permanent improvements were carried out on the farm during the year, chiefly in drainage. Though open drains to an estimated value of some £200 had been put in by the previous occupiers, the system was haphazard with no definite main outlet, and was altogether

unsatisfactory. The system, however, was similar to many farm-drainage schemes to be seen in the district. The construction of a sufficiently deep and adequate main outlet was carried out, together with a suitable flood-gate. A new system of 29½ chains of subsidiary drains was dug to connect up the existing open drains. The farm is thus provided with a good basis on which to plan future drainage operations. Already the effect of the more rapid removal of surface water and improved underground drainage is to be noted in pastures and crops, while the damage done to the land by stock in wet weather has not been nearly so great.

DAIRY HERD AND PIGS.

Owing to difficulty in getting many cows of the herd in calf, and losses from mammitis and other causes, only thirty-two cows were milked through the season. When it was realized that the cows would be exceptionally late in coming to profit it was decided to retain twenty yearling heifers reared on the farm, rather than purchase more stock late in the season. Another factor militating against good returns was the fact that the majority of the cows had been wintered off the farm and had fared badly. The herd-testing returns showed an average per cow of 244 lb. butterfat in 220 days, the short average milking-period being accounted for by the lateness of calving due to the difficulty experienced the previous summer. The total butterfat production showed an increase of only 100 lb. on that of the previous season. However, the herd finished up in excellent condition, and, with the heifers retained, a considerable improvement should be shown in the current season. The cows were wintered on the 26 acres of gum-land, where they were fed the swedes, chou moellier, and some 15 tons of meadow and oaten hay.

The returns from the pigs amounted to £120, this being almost three times the amount received from this section in the previous year. In addition a considerable increase in the number of pigs carried over was made.

FINANCIAL AND GENERAL.

The balance-sheet for the year showed a net profit from Profit and Loss Account of £105, a decided improvement on the position at the end of the first year. The Farm Working Account is still far from satisfactory, but with the improved conditions and a herd of forty-five cows being milked this season the position should rapidly improve. So soon as the initial financial difficulties of the society are overcome more definite experimental and demonstration work can be carried out. The membership of the society is steadily increasing, and at time of writing is approaching two hundred.

Several well-attended field days were held on the farm during the year and the number of visitors is rapidly increasing.

Lemon-growing.—A steady increase is taking place in the area planted with citrus trees in New Zealand, particularly lemons, and satisfactory crops of good-quality fruit are being obtained. In the Tauranga district, which is well adapted for citrus-culture, it is estimated there are approximately 160 acres planted in lemon-orchards.

WEEDS AND THEIR IDENTIFICATION.

(Continued.)

ESMOND ATKINSON, Biological Laboratory, Wellington.

PIGWEED (*AMARANTHUS RETROFLEXUS*) AND LADY'S THUMB (*POLYGONUM PERSICARIA*).

CERTAIN plants have been illustrated and described from time to time in this series for the reason that they were newcomers, with their potentialities as weeds here little known. It is plainly desirable that in the case of a plant rapidly spreading through the country as many people as possible should be able to recognize it when they see it. Other articles have dealt with plants noted for their poisonous properties. Attention is now drawn to another class, consisting of that great army of common weeds of every type of country, among which experience shows that much confusion still exists. Some plants not resembling each other particularly closely have similar or identical popular names; others may be superficially alike but occupy quite different positions economically.

It is intended to use many of the drawings of this series hitherto published and all of those appearing from now onwards as contributions to a complete set illustrating the whole of the weeds found in New Zealand. It seems to the writer that a verbal description of a plant is as a rule either too technical to be of much use to any one but a botanist, or else too vague to convey at all a definite idea of its appearance. What is being aimed at, therefore, is to make the illustrations the final court of appeal, only such facts as colour, scent, variation in size, &c., being described in words.

The drawings here presented illustrate two common weeds about which inquiries are often received at this Laboratory.

Pigweed.

This plant, which is an annual of tropical American origin, is now widely distributed as a weed of waste places and of arable land in the warmer parts of New Zealand. It is commonest north of Auckland, and that is where it is most conspicuous as a weed, but it has been found in parts of the South Island, particularly in the Nelson District, and has been reported from Timaru northwards. It belongs to a small family which is more closely allied to the beets and fat-hens than to any other.

Fig. 1 shows the general appearance of the plant—natural size—and at (*b*) one of its most characteristic features is drawn in outline. This is the long, red, rather fleshy tap-root, which is the name given to roots descending straight down into the soil without branching much. It is this root that gives pigweed its other popular names of redroot and redshank. The stem is rather thick, green, 1 ft. to 3 ft. high, and branching to a certain extent, though small plants bearing ripe seeds may often be seen with only a single stem—upright and unbranched. The flowers are greenish, very small individually, but in a finger-shaped spike sometimes several inches long. There is a

FIG. 1. PIGWEED (AMARANTHUS RETROFLEXUS).

(*a*) Flowering shoot; (*b*) root in outline; (*c*) and (*d*) seeds. (All natural size except (*d*).)

Drawing by Esmond Atkinson.

FIG. 2. LADY'S THUMB (POLYGONUM PERSICARIA).

(*a*) Flowering shoot; (*b*) lower stem and root; (*c*) seeds. (All natural size except two enlarged seeds.)

[*Drawing by Esmond Atkinson.*

single seed in each flower, the seed being very small (*c*), more or less lens-shaped (see (*d*), which shows the seeds from the front and side enlarged), brilliantly shining, and black or brown in colour. As the flowers do not fade in the way that those with conspicuous petals do, little change is visible from the bud onwards, so that many plants apparently in their early stages will be found to be full of ripe seeds.

Generally speaking, proper cultivation will check the spread of pigweed, the thing to aim at being to get rid of it on the first appearance of the flower-spikes. This is the safest way to make sure that no seeds fall to the ground, where they have the power of remaining dormant for many years. They are often found as impurities in various commercial lines of seeds, especially clovers.

Lady's Thumb.

Lady's thumb is a European annual now widely distributed, belonging to the family which includes the docks, sorrels, rhubarb, and buckwheat. There are a number of popular names besides the one used here — *e.g.*, persicaria, smartweed, and knotweed — while it shares with pigweed the name redshank.

The plant varies in appearance from a compact one a few inches high (when it is in the open by itself) to one with straggling stems several feet long (when it is growing among other plants). The drawing shows the shape of the stems with their swollen joints which give it the name "knotweed," while "redshank" describes their colour, which is red or purplish-red, varying in depth with the amount of light that falls on them. The leaves generally have a dark but dim irregular blotch (Fig. 2, *a* and *b*), and this distinguishes the weed from other common ones. The clusters of small flowers are pink, and the shining black seeds are of two distinct shapes—flattened, or triangular in section like a dock-seed (*c*).

Lady's thumb, which is common throughout both Islands, is a weed of damp cultivated ground, and needs a fair amount of moisture for its full development. It is then often very troublesome, particularly in pastures and also in grain crops, where, owing to its growing faster than the cereal, it chokes out the young plants. Thorough cultivation—in time to prevent the formation of seed—is necessary to hold this weed in check. The seeds occur as impurities in American samples of clover.

Arthritis in Lambs.—"An investigation into the cause of this condition was undertaken during the past season," states the Officer in Charge, Wallaceville Veterinary Laboratory, in his annual report for 1926–27, "and specimens were received from four meat-works. An organism has been isolated from these with such frequency and uniformity as to strongly suggest that it is the cause of the arthritis, and this is further borne out by the fact that arthritis can be caused in lambs by injecting this organism into the circulation. It now remains to discover how the organism gains entrance to the body, before means can be taken to prevent its occurrence, and this will involve field observations rather than laboratory work."

PACKING HONEY FOR EXPORT.

POINTS FOR BEEKEEPERS.

T. S. WINTER, Apiary Instructor and Honey Grader, Hamilton.

IN general the quality of the honey shipped during last export season was good, but there was much room for improvement in the condition of approximately one-half of the produce submitted. That is to say, the honey had an excellent flavour and was light in colour, but the general condition could have been improved considerably in a great many cases.

The amount of honey rejected for export each season is still far too great. The reasons for rejection are mainly the following faults: Soft granulation, liquid condition, two grades of honey under one extraction mark, fermentation, low specific gravity, and rusty containers.

SCUM AND FROTH.

The majority of producers lose points each exporting season because their honey is covered thickly with scum and froth. The cause of froth is aeration caused by excessive straining, and this applies more particularly to light honeys of good texture. The presence of scum (foreign matter) on the top of honey when packed is due to tinning too soon after extracting. On many occasions a few packages have been responsible for the deduction of points for scum and froth over the whole line. These packages comprised the top portion of the honey in the tanks before tinning, and were consequently filled last. Where producers are pushed for room, and are obliged to tin quickly, they should place the last few cases from any one tank under a separate extraction mark. For instance, if the line is marked "A," the last three cases should be marked "A2," and so on.

There is a method by which scum and froth can be eliminated altogether at all times and from all extracted honeys, but it calls for extreme care and extra storage room. The honey should be run while liquid into deep, narrow, storage tanks, and allowed to remain until granulation has commenced. It can then be slowly run off into 2 lb. or 60 lb. tins, and will granulate firm, showing no sign of scum or froth. Great care should be taken that the tanks (immediately the honey has cooled) are sealed tightly to exclude all air. The tanks should be filled to the top, and once tinning has commenced it should proceed until the tank is empty.

COARSE GRAIN.

Coarse grain has been the cause of loss to most beekeepers. All honey must be granulated firm before it is passed for export, and the nature of the granulation is taken into consideration by buyers. It cannot be said that honey with a very coarse grain is suitable for table use. In fact, all coarse-grained honey has to be reconditioned before it can be used at all for any purpose; consequently this class realizes comparatively poor prices.

In many parts of the Dominion during the early part of the season the bees work all available sources, thus storing a low-quality honey,

which for some reason takes a long time to granulate and is coarse. This is also the case with honey gathered late in the season. Beech honey is always coarse, and cannot be made first-class, no matter in what condition it is packed, owing to its objectionable flavour.

If the proper method is followed granulation can be controlled, and very coarse-grained honey can be reconditioned in a few days. At extracting-time a small quantity of smooth-grained honey should be placed into each tank of liquid honey, and the whole gently agitated until thoroughly mixed. The whole can then be tinned and sealed. Great care should be taken not to stir too much, or too quickly, otherwise air will be driven into the body of the honey and much trouble will result. The smooth granulated honey is broken up by kneading, and then gently stirred in. The operation should commence immediately the liquid honey has cleared itself of all impurities and the latter have been carefully removed from the surface. The proportion of smooth-grained honey should be not less than one in thirty for freshly extracted honey, or one in twenty for honey that is to be reconditioned. The best honey that any one beekeeper produces may not be good enough. Nothing but the best-conditioned honey, of very fine grain and light amber or white in colour, is suitable for this work.

RUSTY CONTAINERS.

Many lines were noticed in which the tins had not been oiled or lacquered. The owners were extremely fortunate that the packages had had a dry journey to the grading-stores. If the simple method of oiling tins on the outside with boiled linseed-oil before use was followed much after trouble and expense would be avoided.

TWO GRADES IN ONE CASE.

A mistake often made is that of placing two grades of honey in one case. It is impossible to issue a certificate covering such packages without placing the grader, seller, and buyer in a false position. Where there is a distinct difference between the honeys it is wrong to issue a certificate on either the higher or the lower grade. Therefore there is no alternative for the grader but to reject such lines for export when they are submitted. There is, of course, the possibility of a producer having one odd tin each of two grades on his hands, in which case the tins should be packed in cases cut to size and placed with the original lines.

EXTRACTION MARKS.

Extraction marks are often the cause of much trouble at the grading-stores. Some packers use a pencil, others paint marks on the cases, while some place written cards on the lids. The latter are apt to be rubbed off in transit to the stores. It is not always possible to distinguish pencil or paint marks, consequently the grader is put to much extra work and unnecessary trouble. It would facilitate the work, and prevent mistakes being made at the store, if all producers would use a set of 1 in. stencils for this work; the marks to be placed on the right or left top corner of each case. Producers should remember that any work undertaken at the grading-stores which should have been attended to by themselves is a direct charge on those concerned.

INFERIOR HONEYS.

Honeys gathered from ragwort, kiekie, and the beech-tree ("birch") are objectionable in flavour and aroma, and cannot be classed as table honeys. It is a question whether they should not be specially branded before leaving the country. The principal localities in which these honeys are produced in quantity are as follows: Ragwort—King-country and Southland; beech—Westland and Southland; kiekie—Taranaki.

Ragwort is very common in Southland, and many honey outputs are spoilt by its inclusion with the main crop. This can be avoided if beekeepers will work systematically each season in regard to extracting. All colonies should be extracted clean where possible before the ragwort yields, and all subsequent extractions should be specially marked to avoid mixing at the grading-store. The main crop throughout Southland is white in colour. Ragwort honey is light amber; therefore in the event of a beekeeper not being able to extract clean before the ragwort yields it should be an easy matter for him to separate the combs at extracting-time. Better returns will be obtained if this course is followed.

POINTS FOR BEEKEEPERS.

There are many ways by which beekeepers can safeguard their honey against deterioration. Many tons are spoilt each year simply because packers are not careful enough at extracting-time. The following points (largely summarizing the foregoing notes) are given in conclusion:—

(1) Never expose honey to a damp atmosphere.
(2) Cover all tanks to exclude moisture or dust.
(3) Use only clean, dry appliances.
(4) Do not allow honey to run long distances from one tank to another along shallow, open channels.
(5) Use only deep, narrow tanks, circular for preference.
(6) Do not tin honey until it has properly cooled, otherwise trouble may be experienced with granulation.
(7) Do not run warm freshly-extracted honey into a tank containing cold liquid honey.
(8) Endeavour always to keep separate each extraction, and mark cases accordingly with 1 in. stencils.
(9) Remember that excessive straining causes aeration and ultimately much froth on the surface of the honey.
(10) Never store wet extracted combs from one season to another in the honey-packing room, or there will be trouble with fermentation. A shed or room apart from the honey-house should be provided if necessary.

Imported Fruit, Plants, &c.—The annual report of the Horticulture Division for 1926–27 states that most consignments arrived clean and free from disease. One or two lines were condemned and destroyed on account of fruit-fly infection, and a quantity of almonds and walnuts had to be similarly dealt with for Indian meal-moth. Fumigation was found necessary in connection with a few consignments found to be affected with live scale. Importations by parcel-post increased. With very few exceptions bulbs were of good quality, and bulb-mite was considerably less conspicuous.

NEW ZEALAND CHEMICAL RESEARCH.

SOME RECENT REFERENCES ABROAD.

1. Deficiency Diseases of Stock.

ONE of the papers circulated at the recent Imperial Agricultural Conference, London, by the organizing committee dealt with iron starvation (bush sickness). The special interest of the subject to New Zealand readers and the conciseness with which the matter is stated warrant quotation of the paper in full, as follows :—

Iron starvation or bush sickness is a deficiency disease, proved to be non-transmissible, and one that does not spread, occurring in ruminant stock only when pastured on land extending over a wide area in the central volcanic plateau of the North Island of New Zealand and the adjacent country. Some millions of acres are more or less affected, the soil being formed from rhyolitic pumice deposited from air, not water as is usually the case in the formation of soils.

In 1904 an analysis by Aston of the blood of an animal in an advanced stage of the disease showed that there was a great deficiency of iron, which led him to suggest the trial of ferrous sulphate as a top-dressing for pasture upon which sheep were grazed in an experimental paddock. When the results were obtained it led him to suggest that a deficiency of iron in the pasture (the animals' sole ration) was the cause of the disease. After some twenty years' laboratory and field work it is considered fully proved that bush sickness is really iron starvation. Animals in an advanced stage of the disease are fully restored to health on the same feed as that upon which they became affected if dosed with phosphate of iron in the form of Syr. Ferri. Phos. Co. B.P., or with the double citrate of iron and ammonium. If the animal is not so dosed it invariably dies, and if dosed it just as invariably recovers, all the symptoms being those of nutritional anæmia.

It is important to remember that if steps are not taken to prevent the disease in a herd the mortality will be 100 per cent., whereas a non-ruminant — *e.g.*, horses—may continue healthy for many years on the same food and water on which a cow will sicken and die in from six to nine months.

The pasture is composed chiefly of red and white clovers and cocksfoot. Animals taken away for a change to healthy country, and then brought back still in poor store condition, may now be fattened on the pasture upon which they originally became sick. The bones of an animal dead of bush sickness show no signs of malnutrition. These facts indicate that the disease cannot be referred to chronic poisoning, and that a deficiency of some essential element in the food is the real cause.

The abundance of clovers, and the excellence of the diseased animals' bones, preclude the thought that the bone-forming elements, calcium and phosphorus, are deficient in the pasture. Feeding tests have eliminated all other essential elements except iron, which is found to be abnormally low in the affected soils and in the pasture grown upon them.

In "Agricultural Research in the British Empire,"* recently issued from the Reid Library, Rowett Research Institute, Aberdeen, in which work in the different overseas portions of the Empire is treated under geographical headings, five pages are devoted to agricultural research in New Zealand, from which the following extracts are made :—

Malnutrition in Stock.—Though New Zealand is in many ways such an excellent stock country, deficiency diseases occur in some districts. A disease in the bones was noticed some time ago amongst sheep which had moved from one pasture to another. They ceased to thrive, and when made to walk they were seen to be lame. Fractures of the bones were frequent. Post-mortem

* By various authors. A preface by Major Walter Elliot, Parliamentary Under-Secretary of State for Scotland, and an introduction by Dr. J. B. Orr, Director of the Rowett Research Institute, are sufficient guarantee of the care taken in selecting the material for publication. The section on New Zealand is compiled by J. S. Thomson and Dr. Orr.

examination showed that in well-marked cases the bones had become thin and shell-like. An investigation into the cause of this condition revealed the fact that the land on which this condition occurred was deficient in lime and phosphorus. The appropriate measures have been taken to prevent this disease in sheep. It is still, however, prevalent among cattle, especially in heavy-milking cows. These are treated by the administration of substances deficient in the pastures, but there is urgent need for further work in determining the nature of the deficiencies in the various pastures and fodder plants.

A specially interesting case of deficiency disease, known as "bush sickness," occurs in a district in the North Island. The researches of Aston, head of the Chemical Division, have established the nature of this disease, and—what is more important—a successful method of treatment. The chief symptoms are extreme anæmia and emaciation. The administration of iron salts leads to a cure.

Economic Importance of Research.—In view of the attempts being made at the present time to secure co-operation in research within the Empire, it is of special interest to note that all the main lines of research being carried out in New Zealand have a direct bearing on problems in other parts of the Empire. Thus the problems on mineral deficiencies in the pasture are of the same nature as those to which reference has been made in the two previous articles as occurring in South Africa and Canada, and the work on these problems in New Zealand is throwing light upon similar problems elsewhere. Aston's work on "bush sickness" has proved of value in connection with a somewhat similar disease occurring in limited areas in Kenya Colony and in the south of Scotland. In the same way the work on "biological control" of injurious insects and noxious weeds is of general Empire interest. Indeed, some of the work referred to above has already been applied successfully in Australia.

In recognition of the value to the whole Empire of the work in New Zealand on deficiencies in the soils and pastures, a special grant has been made by the Empire Marketing Board Research Committee for an extension of the work now proceeding on the mineral content of pastures. This extended work is to be carried out as part of a general scheme which connects up the work on mineral metabolism at the Rowett Institute, phosphorus deficiency in South Africa, mineral deficiencies in pastures in East Africa—and, indeed, all the important work of this nature throughout the Empire.

An article by C. G. Dickinson, B.V.Sc., on "King Island Coasty Disease," published in the *Australian Veterinary Journal* for September, 1927, makes interesting comparisons between that disease and bush sickness as occurring in New Zealand, and the following extracts are here reprinted :—

The disease known as "coastiness" on King Island was first seen by the writer in April, 1924, and a comparison of the symptoms of this disease with descriptions of the "bush sickness" of New Zealand (which occurs on the pumice lands of the Rotorua district), coupled with analyses of "coasty" soils, led to the belief that the two diseases were similar, if not identical. This belief was strengthened by interchange of correspondence with Mr. B. C. Aston, Chemist of the New Zealand Department of Agriculture, who has for years been investigating the New Zealand disease.

The great difference in iron content in the two classes of soils, coupled with the symptoms of anæmia displayed by animals grazed on "coasty" soils, and the fact that such animals recover when grazed on "sound" soil, points to the trouble being primarily an iron starvation, though it is probable that other factors may operate to a greater or lesser extent. It is known chemically that the presence of alkaline earth carbonates renders iron less soluble, so that it is probable that the high percentage of lime carbonate in "coasty" soil also operates by rendering the iron content (1·413 per cent.) of that class of soil less available.

In the early New Zealand experiments attempts to transmit the disease from one animal to another by means of inoculation and blood-transfusion failed.

Points of similarity between the two diseases, "coastiness" on King Island and "bush sickness" in New Zealand, are as follows :—

(1) In both cases there are symptoms of progressive anæmia.

(2) In both cases diseased cattle are cured by grazing on "sound" country. (By "sound" country is meant country that would cure the disease: there is, on King Island, another type of country called "semi-sound," which will not cause "coastiness," but, on the other hand, it will not cure it either.)

(3) In both cases such cured cattle do not, though cured, improve in general condition until grazed again on "coasty" or "bush-sick" country.

(4) In both cases the soils of affected runs are of a loose, non-binding nature.

(5) In coastiness the disease is developed after about six months' grazing on coasty soil, whereas in New Zealand it takes a longer period (about twelve months). The New Zealand soil has not such a high percentage of lime carbonate, and it was found, in their initial experiments, that when the pasture was top-dressed with lime the disease was contracted much more quickly; in other words, the addition of lime to the New Zealand pastures made them more like King Island natural pastures, with the result that bush sickness was then contracted in about the same time that coastiness is naturally contracted—*videlicet*, in from four to six months.

Having established the close similarity between coastiness and bush sickness, it was decided to apply to King Island conditions the New Zealand preventive, which has been arrived at after years of experimentation. To this end a quantity of lick was made to the following formula: Ferri et ammon. citras 2 oz., brown sugar 4 lb. It is necessary to use the brown sugar as a base for the lick, so as to overcome the bitter taste of the iron salt.

Details of the experiments on calves are then given, which generally showed recovery in the case of six treated with the iron-ammonium citrate. Due acknowledgment is made of Mr. Aston's articles in the *New Zealand Journal of Agriculture*.

2. Wheat-testing.

Among the papers issued by the organizing committee of the Imperial Agricultural Research Conference was one on the testing of New Zealand wheats by the Chemistry Section of our Department of Agriculture, as follows:—

Milling tests of pure varieties of wheats obtained from four different harvests have now been made. Chemical analyses have been carried out on all the flours obtained, and baking tests in a considerable number of cases.

The average amount of flour obtained has been about 73 per cent. of the grain, which must be considered good. Different varieties of wheat have been found to yield different average percentages of flour. Localities, too, have been found to differ in this respect. Canterbury samples have so far averaged about 73 per cent. of flour.

Chemical analyses have shown that the protein content is a useful though variable indication of the baking-quality of the flours. The well-known local variety, Velvet, has yielded the best-quality flour of the more commonly grown wheats. Lesser-known varieties have been found to produce flour of very good quality.

The effect of environment on flour-quality has been noted. Some localities, and more particularly the Tuapeka and Upper Taieri (Central Otago) districts, have proved to be producers of wheat of excellent quality. Tuapeka and Upper Taieri are areas of fairly low rainfall and a good, hot, growing season. Local samples of good quality compare favourably with the best grown in the United States, Canada, and Australia.

A considerable amount of work has been done in attempting to correlate the quality of flours with their chemical composition. The colloidal state of glutens from different flours has been investigated, also the hydrogen ion concentration and the degree of buffering of certain flours. It is hoped that this work will eventually lead to some useful commercial application.

Concerning this work, Thomson and Orr ("Agricultural Research in the British Empire," p. 20) say: "The quality of wheat for bread-making is almost as important as the yield. The staff of the Chemistry Section has been investigating the baking-qualities of different strains in producing a good loaf, and certain important correlations between the chemical composition and the results of experimental baking have been discovered. Further work in breeding and selection is being done to obtain new strains which will combine heavy yields with good quality."

SEASONAL NOTES.

THE FARM.

BREAKING UP STUBBLES.

THE time and method of stubble cultivation depend on the type of rotational farming followed in a given locality. In the sub-humid arable farming districts, such as Canterbury, cereals either end the rotation when grass has been sown with them in the spring, or they are followed by root and forage crops or by grass. Catch-crops of green cereals to provide autumn feed are frequently taken between the cereal and root or forage crops. The earlier the green feed is got in the better, so that the first sowing usually follows early-harvested autumn-sown oats. Algerian oats or Cape barley are the cereals usually chosen for green feed—the latter being generally the most successful when the soil conditions are very dry. On light and medium land the green crop can be most cheaply established by broadcasting the seed on the stubble and covering with a one-way disk cultivator, or by skim-ploughing. The seed-bed for green cereals is also frequently prepared by ploughing and working down in the ordinary way prior to drilling the crop. Although this method entails more time than the previously mentioned one, the work put into the land for the green cereal lightens the cultivation work necessary in the following spring prior to sowing the land in root or forage crops.

On really heavy land it is often impossible to break up the stubbles until the land has been softened by the autumn rains, and much of the wheat stubble land cannot be ploughed till March or April. The teams are usually busy at this period preparing land for autumn and winter sown cereals, so that the stubbles on heavy land are usually left till July or August before they are broken up. Every endeavour should be made to get the land turned over as early as possible, so that it may get the benefit of a winter fallow. There are frequently periods in May and June when land can be ploughed, but the weather conditions are not suitable for cultivation work or for drilling, and it is during these periods that the heavy stubble land intended for roots or forage crops should be ploughed if possible.

Twitch-infested stubbles require careful treatment. It is bad practice to leave fallow over the winter land that has been finely worked in the autumn by cultivation for twitch. It is impossible to drag out all the twitch roots, and any that are left will grow with great vigour in the finely worked seed-bed. Stubble land infested with twitch should not be followed by roots, but by some smother crop. The stubble land should be skim-ploughed immediately after harvest, and all the surface twitch worked out with the tine cultivator, rolled up with the chain harrows, and burnt; the land should then be deep ploughed and sown immediately in a smother crop. The two best smother crops are oats and vetches for hay, or Italian rye-grass. Oats and vetches make a dense sward which practically prevents any light getting to the surface soil, and so checks the growth of any twitch remaining in the land. This crop also has the additional advantage

that it can be sown fairly late—April or May; but, on the other hand, its production does not usually suit the economy of the ordinary arable farm which is mainly devoted to the production of fat lambs. Italian rye-grass provides the fat-lamb raiser with an excellent feeding crop, but unless it is got in by the end of March or early April it usually fails to make the vigorous growth so necessary for the production of a dense sward to keep the twitch under control.

In South Island arable farming districts most of the short-rotation grass is sown down with oats in the spring or rape in November, and it is rare for a short-rotation pasture to be autumn-sown after a cereal. Sowing at these periods allows of cheap establishment of the pasture, the cost of cultivation of the land being paid for by the rape and oat crops. In the North Island, however, long-rotation and permanent pastures are often autumn-sown after oats. Although a cereal may not leave the land in an ideal condition for grass, it is frequently very difficult to choose any alternative crop to precede the grass which will allow of the pasture being sown early in the autumn. When grass follows summer forage crops the seed-bed often cannot be prepared till late April, which in many seasons is rather late for the best establishment of the clovers and grasses. When preparing the seed-bed for grass after cereals it is important to get the land ploughed as early as possible. This allows of full benefit being obtained from the weathering effect of the autumn rains. Early sowing is preferable to late sowing, as it allows the clovers to become well established before the early winter frosts, but in very dry seasons sowing should be delayed until rain has fallen and a good seed-bed has been obtained; this gives better results than early sowing on a dry and badly prepared seed-bed.

STOCK-MANAGEMENT.

A fairly large proportion of the sheep offered at the annual sheep fairs are very poor in condition, even in seasons when the growth of grass has been quite good. It is probable that by general adoption of the best management and feeding practices the condition of the sheep could be greatly improved to the mutual advantage of both the grazier and fattener. This applies particularly in the case of ewes culled for age by the grazier and used by the mixed farmer for fat-lamb raising. At practically all sheep fairs one notices drafts of four- and five-year-old ewes that are in very poor condition, and consequently bring a poor return to the grazier and are often a doubtful investment for the mixed farmer. The general practice is to cull the aged ewes from the main flock at weaning-time; the best practice, however, is to divide off the old ewes the year previous to culling, and during the next breeding season keep the old ewes separate from the rest of the flock. Practically all grazing-runs provide sufficient subdivision to allow of these older ewes being kept separate from the rest of the breeding-ewes, thus making it possible to give them the best of the grass right through the season. In many cases they could be lambed slightly earlier than the rest of the flock, and this, together with the better feed and the absence of competition with the younger sheep, would put them in good condition and enable them to do their lambs well. They should then be in good condition in February when finally culled for age, and realize a fair price at the sheep fairs.

On the fat-lamb-raising farms in the North Island the rams are usually put out at the end of February or early in March. Flushing, by feeding the ewes on some succulent feed for a week or ten days before the rams go out, helps to increase the lambing percentage. Flushing can be done by running the ewes on rape after the first feeding off by the lambs, or, where there is no rape, on the best pastures available.

The supplementary feeding of dairy cows during dry autumn weather should receive careful attention. The feeding of green crops, roots, or ensilage should commence before the grass-growth goes off badly and the milk yield falls, as it is much more difficult to raise the yield once it has fallen than to maintain it by supplementary feeding.

—P. W. Smallfield, B.Ag., Instructor in Agriculture, Ruakura.

THE ORCHARD.

SPRAYING.

THE spraying season is gradually drawing to a close for this season's crop, but that does not imply that operations should cease at once, there still being ample time for pests and diseases to do much damage before the later varieties of apples are harvested. Codlin moth and leaf-roller caterpillar will still be active, and must be controlled by sprayings with arsenate of lead—driving the spray with considerable force, so that every part of the tree will be covered. Much fruit is rejected for export on account of codlin-moth stings and the eating of the skin of the apple by the leaf-roller; consequently every precaution should be taken by getting in first with the spray, and thus turning into profit apples that might otherwise be wasted. Black-spot has been known to make its appearance late in the season, especially on varieties like the Dougherty, and a lime-sulphur spray towards the end of the coming month will often prevent an attack.

From now on till picking-time growers should as far as possible arrange their spraying so as to reduce spray stains to a minimum. This applies more especially to export fruit, although apples covered with spray stains are unsightly for the local market. If it is found necessary to spray with the lime-sulphur, Black Leaf 40, and arsenate-of-lead combination for the control of red mite, leaf-hopper, &c., late in the season, it may be advisable to spray the trees with clear water just prior to picking, as the residue from this spray gives the fruit a dirty appearance, necessitating wiping before submitting for export.

REWORKED TREES.

Where trees grafted this season have not yet received any attention a number of growths will be showing from the limbs below the grafts. It is not advisable to destroy all those until the grafts have made a fair growth, and then sufficient should be left to ensure that a good balance is maintained between foliage and roots. These growths may be occasionally pinched or stopped to

stimulate the development of the graft. A strong, suitably placed growth should also be selected where any scion has failed to grow at grafting-time. This can be budded during January or February.

HANDLING THE CROP FOR EXPORT.

There is every indication of a very large export of apples this season, and although the importance of careful handling of the crop for shipment has been emphasized during the past few seasons some of the chief points may be restated. Export starts in the orchard, although the practice adopted by some growers might lead one to believe that the actual wrapping of the apple and placing it in the case rectifies every mistake made previously, and satisfies all requirements. It would be quite safe to say that orchardists are losing hundreds of pounds every season through careless picking. The apples are pulled from the tree, with the result that either the fruit spur comes away with the fruit, or the stalk, with a portion of the apple, is left attached to the fruit spur, rendering the apple useless for export. Should the stalk be intact it will be ruptured so badly as to cause the apple to rot. Growers will do well to caution their pickers against carelessness in this respect.

When grading, either by hand or machine, the less the apples are handled the better. The common practice of dropping the apples, instead of placing them, increases the chance of bruising. A little extra time spent when sizing and grading is well worth while, and makes the packing of the fruit much easier. Careful study of the regulations governing grading, sizing, colour, russet, &c., will simplify matters, and probably save rejections when the fruit is submitted for examination. The apple packing charts now issued are so complete and full of details that even an inexperienced packer can hardly make a mistake, providing an average amount of common-sense is used.

The experience gained with the Canadian case last season will enable packers to start with more confidence this year, and a good pack should result. No doubt the various reports from overseas have been considered; any points for the good of the fruit-grower and the placing of our fruit on the market in the best possible conditions should be acted upon. Competition is keen, and it is only by attention to all details that we can hope to retain the high position our fruit now holds on the overseas markets. Record making or breaking is not required when packing apples for export. Uniform sizing, good grading, neat wrapping, fairly loose packing creating large pockets, and a good bulge are the essential points required in packing the new case. There is still room for improvement in the labelling and stamping, and growers should realize that general appearance does much towards sale of the fruit.

—G. Stratford, Orchard Instructor, Motueka.

Citrus-culture.

With prolonged dry weather citrus-trees will be retarded and suffer a loss of foliage according to the amount of moisture available. Continued cultivation is the first essential to conserve moisture; the

destruction of weeds is also very necessary, as much moisture escapes from the soil through these growths. Wherever rough litter such as hay, straw, or stable manure is available this should be spread over the rooting area to form a mulch, affording protection against evaporation and maintaining a more equable soil temperature.

Irrigation is not necessary, as a rule, in citrus groves, but there are occasions when it could be used to advantage. Citrus-trees make their greatest demand on the water content of the soil during the period of minimum rainfall, and satisfactory growth and development cannot take place when moisture is not available. It is worth considerable effort to supply water, and the response will often save defoliation and loss of crop. Applications of water are best given in trenches, which should be levelled down after the water has soaked in.

—W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

SELECTION OF BREEDING MALES.

THE early-hatched cockerels should now be carefully gone through and the best specimens selected for future breeding purposes. In this important work it is always a wise course to select about double the number of birds that will be required for the next season. This is because even the most promising specimen now may later on develop some serious defect or weakness which would condemn it as a breeder. Thus, unless due allowance is made by having good numbers for the final selection, annoyance and disappointment may be easily experienced when the next breeding season comes round.

In the selection of breeding males the necessity of giving points indicative of health and vigour the first consideration cannot be too strongly urged. The chief signs of this condition are a bright, prominent eye, face free from feathers, good bodily development (especially in front), width across the back, tight feathering, sturdy legs set wide apart, and generally an alert active appearance. Always beware of the extremely early maturing male. During the early growing stages it may look a pretty little bird, but it usually remains a pretty little bird, and being a diminutive specimen it should not be bred from. Usually it is the big-framed, slow-maturing cockerel, possessing the points as indicative of health and vigour, which makes in the long run the best male to head a breeding-pen. In addition to the other desirable points mentioned an endeavour should always be made to select birds that conform to breed-type, or, in other words, standard requirements of the breed they represent.

After the best birds have been selected they should whenever possible be given a free range. It should be borne in mind that the more natural the conditions the young birds are placed under the more naturally will they develop. Confined quarters are always undesirable for the future breeding male. They not only tend towards unhealthy growth through weak legs, &c., but the production of large falling-over combs is also encouraged. The latter point, of course, chiefly applies to heavy combed breeds such as Leghorns, Minorcas, &c.

It is a mistake to give the promising breeding cockerel too much forcing food such as meat and milk, as these tend towards a forced but weak development. A liberal but plain nourishing ration should be provided. Above all, the quarters should be kept strictly clean and free from insect pests, otherwise sound development cannot take place.

BREEDS FOR THE FARMER.

A correspondent wishes to know which is the best breed of fowl for the farmer to keep for profit-making. The answer is that there is no best breed. There are good and bad layers in all breeds, as the egg-laying competitions have undoubtedly proved. The results of these tests go to show that there is often as much difference in egg-producing capacity between birds of the same breed as there is between the different breeds. Thus in choosing a breed the matter of strain and constitutional vigour are the chief points for consideration, providing, of course, that the breed selected is of an egg-laying type. At the present time throughout New Zealand the White Leghorn is the most popular breed, but being generally a non-sitter it cannot be regarded as an ideal farmer's bird, except in cases where artificial methods are used for the hatching and rearing of stock.

It will thus be seen that the question of local conditions must also be taken into account. This being so, the novice should select a breed that will best suit his own individual requirements. On the farm, where generally hatching and rearing are carried out in the natural way, one of the heavier breeds such as the Black Orpington or White Plymouth Rock is recommended. Given a good laying strain of these breeds, they should possess the combined qualities which go to make an ideal farmer's bird. While at the present time the White Leghorn is mostly favoured for heavy egg-production, and the Black Orpington as a dual-purpose breed, it is to be regretted that many breeders of the Orpington, in their desire to increase egg-production, have robbed it of some of the qualities which were considered of paramount importance when the breed was first established. The object aimed at was to produce what might be termed a triple-purpose breed—a fairly good layer, a good table bird, and one which could be depended upon for the hatching and rearing of stock at the right season of the year. Unfortunately, to-day in many cases the Black Orpingtons seen, as a result of continuous breeding for egg-production, and by the introduction of Mediterranean blood, have been fined down to such a degree that they fail to provide even a decent table carcass. Moreover, with the broody propensity being more or less eliminated, they cannot be depended upon for the hatching and rearing of stock till probably too late in the season for the chickens to do their best. Obviously such stock, and particularly if they lay undersized eggs, have few if any qualifications to recommend them as a farmer's bird compared with a White Leghorn which conforms to the utility standard weight requirements.

From a farmer's standpoint, if he is to have chickens bred to lay during the dear-egg season, there are two alternatives: he must either use incubators for hatching or purchase day-old chicks from a reliable breeder and rear them in an up-to-date brooder. With the improved incubators and brooders now on the market, and the knowledge available

in regard to their working, the production and rearing of chickens is not nearly so difficult as is usually imagined by those who have not had experience in this work.

COMBS AND WATTLES.

Another correspondent asks whether a large comb carried by a hen is a sure sign that she is a good layer. The answer to this is that the comb is merely an ornament, and its size does not necessarily indicate egg-producing power. In days gone by most of the Mediterranean breeds had large combs, and as these were generally looked upon as the best layers it was therefore believed, and is still thought by many, that to breed from birds with the largest combs was to breed for the best layers. This view, however, does not hold good to-day, as there is ample evidence that many of the birds which have produced record yields in the egg-laying competitions and elsewhere carried a more or less medium-sized comb of their breed. In my opinion, breeding for excessive combs directly injures a strain from a utility standpoint. A large heavy comb is apt to fall over to such an extent as to prevent a hen from seeing with one eye. Obviously such a bird suffers a severe handicap in securing its food as compared with another which has the full use of both eyes. Then again, in the case of a male bird carrying a large comb it is rare if ever that he can be depended upon to produce a high proportion of strong easily reared chicks, unless, of course, the comb is first removed or "dubbed."

The same remarks apply with equal force to extremely long wattles, as these, especially if the bird is fed in deep litter (which is necessary in the majority of breeding-pens), prevent it from feeding to the best advantage, with a consequent falling-off in condition. Large combs and long wattles usually go together. They may be all right from a fancier's point of view, but when profit-making is the object aimed at no good can be claimed for them. Even for the table bird a large comb has no special value whatever, as it is always cut off and thrown away.

In our utility-poultry standards a more or less medium comb is aimed at, and it behoves all breeders and judges of utility stock to do all possible to bring about this much needed improvement. Although the comb may be looked upon as merely an ornament, every endeavour should be made to breed birds with combs conforming to standard requirements. The aim should be to combine beauty—in other words, breed-type—with usefulness.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

TAKING SURPLUS HONEY.

WHERE the beekeeper has succeeded in getting his colonies into good order for the honey-flow there should be some honey for extracting by the end of the month. If the stocks of surplus combs on hand are not sufficient to harvest the crop there is a danger that the immediate requirements of the bees may not be met. It is well,

therefore, to look over the upper stories and note those which contain sealed honey. These can then be removed and extracted, and returned to the hives to be refilled.

In this early extracting great care must be exercised not to remove any combs but those which are fully sealed, as in the height of a honey-flow much unripe honey will be present in the hives, and this, if extracted, is likely to ferment. The practice of extracting from unsealed combs during a flow cannot be too strongly condemned, as it results in the production of honeys of poor flavour, coarse grain, and low specific gravity. All partly sealed combs should be left on the hives until after the flow, in order to get the honey in them well ripened.

Extracting during a flow has advantages, providing the above precautions are taken, as fewer combs are required and little or no robbing has to be contended with during the tedious process of removing honey from the hives. Where ample stocks of combs are on hand to meet the demands of a large flow the hives can be supered as required, when the work of dealing with the crop may be left until the end of the season. If this practice is followed the beekeeper will be assured of a well-ripened honey of good quality and high grade.

USE OF BEE-ESCAPES.

For removing honey from the hives there is no better device than the bee-escape. The usual practice followed when the time for extracting is at hand is to remove the frames one by one. If excluders are used much time will be saved in picking over the combs. As the combs are taken from the hives shake the bees in front of the hive, brush off the remaining ones, and place the combs in a hive body for removal to the honey-house. Some beekeepers practise removing full supers, which are bumped on the ground to cause the bees to fall from the combs. This is not a good plan, as during the operation many bees are killed, combs are broken, and robbers are soon in evidence. Others practise smoking between the combs excessively, in order to get the bees out of the supers. There is danger in this method of demoralizing the colony, resulting in it being an easy prey to the robber bees, and causing the attendant risk of injuring the quality of the honey by tainting it with smoke.

There is no more satisfactory way of getting the bees out of the supers than by the use of escapes, and when their advantages are weighed it is a matter of surprise that they have not been more largely adopted. There is no stinging, smoking, brushing, or robbing when the honey is removed. Escapes are now made for the greater part of wire cloth. The advantage of this is that it allows the warmth from the bees to pass into the super during the night, thus keeping the honey warm; the bees can also clean up the drips of honey that fall from the burr combs. In inserting the escapes gently prize up the super from the brood-chamber and insert the device. A puff of smoke will suffice to control the bees while the operation is being performed. If this is done late in the afternoon the bees will have gone down to the brood-chamber before the following morning, and the honey can then be taken off without disturbing them. A word of caution to those who have not formerly

used the escapes: Should there be brood in the super combs the bees will not leave, and the escapes will not prove effective in ridding the supers.

FOUL-BROOD.

Opportunity should be taken when removing the surplus honey to make a searching examination of the brood-chamber for disease. In this matter the beekeeper should ever be on the alert, and if disease is noticed in any of the colonies the surplus honey from such should be set aside to be extracted when all other extracting is finished. Many beekeepers spread the trouble by careless handling of diseased colonies at extracting-time. The combs from infected hives should be sterilized or destroyed after the honey has been extracted.

HONEY-HOUSE.

It may be well to remind beekeepers who have only a few colonies and who make use of existing buildings for extracting, of the requirements of the regulations under the Sale of Food and Drugs Act. These provide that "every place used for or in connection with the sale, manufacture, preparation, storage, or packing of any food for sale shall be used for that purpose only; and no place shall be so used which is at any time used as a sleeping apartment, or in which any animal is allowed to be, or which is or has been used for any purpose which would be likely to contaminate such food or injuriously affect its wholesomeness or cleanliness."

The above conditions make it obligatory on the part of the beekeeper to exercise scrupulous care and cleanliness in handling honey as an article of food. The first requisite is a bee-tight house, having wire cloth screens fitted with escapes on the windows. These screens are necessary to allow bees which enter with the supers to escape, and to prevent the entry of robber bees which are attracted by the smell of the honey. Now that electric light is available to most beekeepers it will be found to be a distinct advantage to employ it for lighting the extracting room. If this method is adopted the room is best divided into two compartments; the part containing the extractor, uncapping box, and supers of honey can be artificially lighted, thus allowing the bees to pass through the doorway to the window in the end of the storage room. Thus the operator is not hindered by the flying bees, and the tanks do not require to be covered; moreover, any robber bees which may enter will be immediately attracted to the lighted window.

EXTRACTORS.

Extractors are made in different sizes—from two to six frames. In the choice of an extractor a beekeeper will be guided by the number of colonies he is operating. For any number of colonies up to one hundred he will find a two- or four-frame reversible most convenient. For more than a hundred colonies it will pay to install a power machine. A recent decision of the Health Department renders it possible now to use extractors made of galvanized iron without coating them with beeswax internally. The application of wax to the machines was considered necessary in the interests of health. However, this has been dispensed with on the strict understanding that the equipment is kept

in scrupulously clean condition. Too often extractors are left without cleansing after the season's operations, and during the winter the acid in the honey attacks the metal, rendering it well nigh impossible to thoroughly cleanse the machines before they are again brought into use. Apart from this all traces of honey should be removed, as it is liable to ferment, and in the course of time the whole outfit becomes soured and permeated with destructive bacteria.

HONEY-TANKS.

For the preparation and care of the honey after extracting it is necessary to provide suitable tanks. These should be made of tinned steel and externally soldered, in conformance with the regulations under the Sale of Food and Drugs Act. It has been proved by experience of late years that deep, narrow tanks are the most suitable. These tanks obviate to a great extent the disagreeable necessity of straining the honey, and help to eliminate both froth and scum, which otherwise render the honey unsightly when it rises to the surface.

EXTRACTING.

To do the work expeditiously two people should be engaged—one to do the uncapping and the other to operate the extractor. In the process of uncapping the comb is placed on the cross-bar on top of the uncapping can. The projecting screw point prevents the frame from slipping and acts as a pivot on which to revolve the combs. The comb should be placed with one end resting on the pivot and tilted slightly forward, in order to allow the cappings to fall away from the combs as they begin to peel off. For removing the cappings what is known as the Bingham knife is usually first favourite. Provision must be made to keep the knife warm, and this can be accomplished by immersing it in hot water. The knife should have a keen edge, and be thoroughly clean before starting operations. Uncapping should commence at the bottom, and the knife proceed with a forward and backward motion, the same as when using a saw. Make a practice of uncapping as wide a surface as possible, and endeavour to remove the entire surface of the comb without once removing the knife. A little experience will enable the operator to cut below the surface of the cappings, remembering the cleaner the cut the freer the honey will be of wax particles when extracted.

After the combs are uncapped the problem of dealing with the cappings must receive consideration. Where these are stored for an indefinite period the honey may granulate or take up moisture from the atmosphere and thus become a total loss. If the beekeeper does not possess one of the melters in general use he should improvise some means for straining them. A hive-body covered with coarse wire cloth at the bottom and placed in a tray with a lip provided at one end to drain off the honey will answer the purpose for small quantities of cappings. For dealing with large quantities it is well to install a good melter, but before doing so the beekeeper should satisfy himself that it will not impair the quality and colour of the honey.

RETURNING THE COMBS.

After the combs are extracted they should be placed on the hives in the evening. If this practice is followed the bees have a chance

to clean them during the night, and robbing is not likely to follow. Nothing will excite the bees more than wet combs placed on the hives during the day; they promote wholesale robbing, and, moreover, the bees take advantage of the opportunity to enter the honey-house every time the door is opened.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

HARVESTING THE TOBACCO CROP.

THE earlier planted tobacco crops will now commence to mature their leaves. This is indicated by a change in colour and texture from a dark green colour and pliable condition to a yellowish green and a more brittle leaf. Sometimes the yellow colouring develops in spots and patches. This change first takes place in the lower leaves, and gradually spreads to those higher up on the stalk. For this reason in countries where labour is abundant the priming method of harvesting is sometimes adopted. The individual leaves are gathered as they ripen and attached to the curing sticks which are hung in the barn to cure, thus securing the greatest possible uniformity and a maximum of first-grade leaf. More usually it is the custom to harvest the leaves and cure them on the stalk by splitting the stalk to within a few inches of the ground and then cutting it off just above ground level. The plants are then left for a few hours to wilt; they are then threaded on the curing sticks and placed in the curing barn.

It is desirable to harvest the tobacco crop during the warmer weather, as the leaves then carry the natural secretions which give them aroma and other desirable qualities when cured, also the natural high temperatures facilitate the work of a successful cure. For some of these reasons it is desirable to avoid cutting after heavy rains when the leaves are thin and in comparatively poor condition. Every consideration should be given to the operations of harvesting and curing, as an excellent crop may very easily be spoiled by any mismanagement. Leaf that is immature will retain a greenish colour when cured and have a bitter flavour, while overmaturity results in uneven colouring without the desirable elasticity in the cured leaf. Great care is needed in all handling to avoid bruising the leaf, as such injuries will cause discoloration and lower the grade. All plants should be free of dew and moisture before cutting and be placed under cover the same day as they are cut; it is not desirable to leave any outside over night.

In the curing shed the sticks threaded with tobacco plants are placed with the ends resting on parallel scantlings, known as tier poles, in such a way that they will just hang clear and allow a current of air to pass through them. There are usually two or three such tiers 3 ft. to 4 ft. apart.

It is desirable, if possible, to keep the atmosphere a little close at first to further develop the yellow colour in the leaf, and later to induce a drier atmosphere by opening the ventilators and so fixing the desirable colour. This air-curing is the natural method, and is

used chiefly for pipe and cigar tobaccos. In the case of cold, wet weather while this operation is taking place there is a danger of the leaf rotting, a condition known as "pole-sweat"; or during a period of warm winds if the leaf is dried out too quickly it will retain a green colour with poor flavour. Under the former circumstances small fires of dry hardwood placed about the floors will improve the conditions. At this season, however, the weather is very suitable for carrying out the operation of curing with the least danger and difficulty.

For curing the light-coloured leaf that is in such demand for cigarette tobaccos a heated flue kiln is required. This is usually 20 ft. square and nearly as high, with a large metal flue running round three sides at floor-level. Considerable experience is necessary to operate it successfully. The kiln is fully charged by hanging the plants in tiers as mentioned above; the kiln is then tightly closed and the fires lit. The heat radiates from the flues, but the smoke passes through a smoke-stack into the open air. The general method is to start with small fires and raise the temperature gradually. Meanwhile in the humid warm conditions created the leaf gradually assumes the requisite yellow colour. By further increasing the temperature, and reducing humidity gradually by means of ventilation, the leaf is dried out and the colour maintained. To do this well the nicest judgment and adjustment are required, but under proper management high-grade leaf may be cured in a week, as compared with the six weeks or so required for air-curing, although the latter method requires less skill and attention and larger barns can be used.

TOMATOES.

The hard season has revealed very plainly the value of the advice often given to raise sturdy tomato plants of good strain in moderate heat, and thoroughly harden them off gradually. Such plants have stood the severe test of a cold season successfully. Other types are uneven in growth and attacked by disease. In this weakened state they have fallen easy victims, and any amount of spraying only results in a meagre crop some time after the usual date for the first picking. This condition is specially noticeable in the outside crop. The best preventive of disease is a vigorous plant of good constitution.

The season for the inside crop is about over, and the success of next year's crop will very largely depend on the preparations that are commenced now. Instead of neglecting the glasshouses and allowing them to breed disease, the roots of the plants should be lifted and the plants left in the strings to dry out. They should then be gathered and put on the fire heap. This fire should be a well-thought-out installation. A sufficiently large cutting in a bank, with a few fire bars to keep the heap off the ground and prevent rotting and to facilitate kindling, is a good arrangement, and it makes a first-class incinerator. The ashes obtained make a good contribution to the compost heap.

Thoroughly clean down the house by spraying or fumigation, and sterilize the soil as may be required. Scarify in a quick-growing cover-crop, and grow it with ventilators wide open. This is the most effective way of destroying insects and fungi before they get established and settle down into their winter quarters. It also supplies humus and nitrogen in a clean and suitable form.

Growers will now be busy marketing the outside crop of tomatoes. These, if suitably graded and packed, should be profitable if they are well distributed. There is often a tendency to ship automatically to the nearest big centre of population, and such markets are too often glutted while provincial demands are not supplied. The subject of distribution is never finalized, and demands the very alert attention of the producer at this season.

SMALL-FRUITS.

Most growers of raspberries and loganberries will now have completed their harvest, and the old canes should be cut, carried out, and burned. Remove also all small useless growth. The cropping canes may then be fed with suitable manures as required. Most plantations are attacked by scale or other insects and fungi; one or two applications of a suitable spray at the present time would be most effective in countering these attacks.

Where strawberries are to be planted the preparation of the land should now be completed. Where it is customary to crop the beds for three or four years it is of special importance that this preparation should be thorough, particularly as regards such bad weeds as couch-grass and sorrel. If the preparation in this respect has not been successful it is not advisable to plant strawberries. It is surprising to notice how often planting is done on such infested areas, where disappointment is inevitable. Complete the preparation by obtaining a firm bed with a fine even surface, and put out the plants as soon as they are obtainable—especially in southern districts.

A similar preparation should now be made for small-fruits to be planted out in early winter. Sow seeds of Cape gooseberry and passion-fruit to produce plants for putting out in the spring.

VEGETABLE CROPS.

Harvest crops of onions, shallots, early potatoes, &c., as soon as they mature. There is considerable risk of second growth if the crops are allowed to remain in the ground and get the autumn rains after that stage is reached. If the onions are of a non-keeping kind, grade them as the market requires, and pass them into consumption; keeping sorts should be thoroughly ripened and placed in a dry airy place. Large stocks require careful supervision.

The potato crop for consumption is best kept in a dark cool shed of considerable humidity, in order to avoid greening and shrivelling and sprouting. The results of next season's crop will be enhanced if the seed is chosen from the best plants of true type. These tubers are best ripened in the light, but care must be taken to avoid shrivelling and attacks of the potato moth, which is sometimes about.

Among the newly sown and planted crops the weeds will quickly get ahead once the autumn rains really begin. To control them take advantage of fine weather to hoe the crops, and do it before the weeds attain much size.

Keep the celery and other winter crops moving. Water and feed crops of the gourd class. Sow spring cabbage and cauliflowers, also spinach, parsley, and lettuce.

—W. C. Hyde, Horticulturist, Wellington.

TESTING OF PUREBRED DAIRY COWS.

DECEMBER CERTIFICATE-OF-RECORD LIST.

Dairy Division.

DURING the past month of December ninety-five cows received certificates under the C.O.R. system. Details of the records are given in the following list :—

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS.						
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Ivondale Gold Bird ..	G. A. Mills, Ngahinapouri ..	1 349	240·5	365	12,091·5	573·38
Holly Bank Mary ..	J. Nicolson, Hawera ..	1 347	240·5	365	9,826·9	544·60
Woodstock Farewell ..	Mrs. A. Banks and Son, Kiwitea	2 44	244·9	365	9,337·8	540·87
Jerseydene Ruby ..	T. Wells, Awakino Point ..	2 10	241·5	365	9,639·9	540·87
Linda of Adare ..	G. A. Mills, Ngahinapouri ..	1 238	240·5	365	8,602·8	483·98
Conandale Model's Pryde	S. Dale, Fairlie	1 295	240·5	364	7,516·3	468·80
Brentwood Caprice ..	C. A. Willis, Pukekohe ..	1 318	240·5	365	9,039·6	453·49
Glenmore Rosette ..	A. C. Lovelock, Woodville	2 13	241·8	365	7,159·8	450·06
Holly Oak Waterwings	G. A. Mills, Ngahinapouri ..	1 354	240·5	365	8,686·8	447·34
Te Aute Tinsel ..	W. T. Williams, Pukehou ..	1 362	240·5	365	7,696·0	439·96
Burnside Winsome ..	S. J. Hollard, Rowan ..	2 43	244·8	365	8,243·0	435·46
Kuku Perfection ..	R. L. Horn, sen., Ohau ..	2 56	246·1	365	8,820·7	427·35
Uruti Martha ..	W. Oxenham, Uruti ..	2 26	243·1	362	6,861·1	421·38
Woodstock Zena ..	Mrs. A. Banks and Son, Kiwitea	1 361	240·5	365	7,794·5	419·96
Jersey Meadows Jewel	H. H. Phillips, Te Rehunga	2 25	243·0	365	6,821·8	402·26
Craigalea Topsy ..	J. G. Robertson, Eltham ..	2 16	242·1	353	7,402·6	402·01
Clar Innis Lynnette ..	A. Buchanan, Palmerston N.	2 7	241·2	365	6,489·0	401·23
Glenmore Lena ..	A. C. Lovelock, Woodville ..	2 45	245·0	322	7,034·3	400·61
Ohape Graceful ..	W. Westaway, Temuka ..	2 69	247·4	365	6,295·2	382·77
Jersey Lea Chance ..	J. T. Entwisle, Cambridge ..	2 29	243·4	365	6,662·3	376·57
Courthay Dolly Dimple	P. C. Short, Lowgarth ..	1 301	240·5	365	5,912·1	344·34
Maesbury Judy ..	C. Bowles, Burwood ..	2 17	242·2	332	5,821·9	343·11
Dominion Delight ..	Ruakura Farm of Instruction, Hamilton	1 348	240·5	351	5,635·1	324·12
Woodlands Bright Hope	W. Oxenham, Uruti ..	1 325	240·5	291	6,011·3	317·92
Courthay Snowflake	P. C. Short, Lowgarth ..	1 344	240·5	365	5,876·3	300·71
Daisy's Princess ..	C. P. Crowley, Kaponga ..	2 70	247·5	306	4,734·4	288·39
Senior Two-year-old.						
Dominion Golden Floss	Ruakura Farm of Instruction, Hamilton	2 354	275·9	365	12,287·3	663·14
Ivondale Pure Gold ..	W. H. Jakins, Christchurch	2 336	274·1	365	10,531·3	581·68
Glenmore Sensation ..	A. C. Lovelock, Woodville ..	2 348	275·3	365	8,019·1	526·15
Dorothy's Dolly ..	A. S. W. Hazard, Waimate N.	2 361	276·6	365	8,352·5	490·44
Woodstock Floral ..	Mrs. A. Banks and Son, Kiwitea	2 347	275·2	365	7,954·8	425·19
Woodstock Freda ..	Mrs. A. Banks and Son, Kiwitea	2 241	264·6	328	6,880·5	408·23
Dominion Golden Fancy	Ruakura Farm of Instruction, Hamilton	2 344	274·9	303	8,334·2	401·48
Beauty's Queen ..	A. E. Sly, Whakaronga ..	2 95	250·0	350	6,999·0	374·46
Middlewood Glory ..	A. Stackhouse, Kiwitea ..	2 110	251·5	299	5,353 9	310·19

LIST OF CERTIFICATES—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		JERSEYS—*continued.*				
Three-year-old.		Yrs. dys.	lb.		lb.	lb.
Holly Oak Primulet ..	Kilgour Sisters, Kiwitea ..	3 282	305·2	365	12,008·4	698·22
Pawa Shell ..	F. S. McRae, Palmerston N.	3 339	310·9	365	11,297·8	601·78
Dominion Avis ..	Ruakura Farm of Instruction, Hamilton	3 319	308·9	365	10,422·0	560·21
Maid's Farewell ..	D. Marra, Dargaville ..	3 84	285·4	365	9,241·3	538·94
Craigalea Ruby ..	J. G. Robertson, Eltham ..	3 25	279·5	365	7,787·9	511·15
Rosedale Queen Elizabeth	E. J. Adams, Puni ..	3 72	284·2	353	9,635·8	441·20
Distinction's Magnet	A. Hyland, Thornton ..	3 306	307·3	365	8,794·3	435·56
Leighurst Coquette ..	R. K. Garland, Okauia ..	3 349	311·9	364	8,385·2	398·11
Twin Flower ..	J. Torbet, Waiau Pa ..	3 233	300·3	365	7,902·6	392·31
Greenbank Geisha ..	W. A. Burgess, Ruawai ..	3 102	287·2	359	6,846·3	384·60
Aldan's Glory ..	G. R. and H. Hutchinson, Auckland	3 343	311·3	297	6,813·6	382·53
Four-year-old.						
Middlewood Daisy ..	Kilgour Sisters, Kiwitea ..	4 51	318·6	365	9,866·9	611·06
Woodstock Bargee ..	Mrs. A. Banks and Son, Kiwitea	4 37	317·2	365	8,954·9	487·63
Dominion Rozena ..	Ruakura Farm of Instruction, Hamilton	4 350	348·5	365	10,120·3	468·04
Strathlea Sunshine ..	H. H. Phillips, Te Rehunga	4 356	349·1	357	7,598·7	406·64
Dunira Delight ..	W. K. Mackie, Dargaville ..	4 19	315·2	345	7,681·8	391·86
Mature.						
Flandrine's Vixen ..	R. E. Clements, Awakino Pt.	7 325	350·0	365	12,598·8	722·42
Picotee's Nancy ..	N. Moore, Tapanui ..	8 293	350·0	365	10,713·1	662·84
Dominion Flo ..	Ruakura Farm of Instruction, Hamilton	9 60	350·0	365	12,308·0	637·63
Ivondale Darkie ..	S. G. Morgan, Woodville ..	6 56	350·0	365	11,495·4	623·12
Fleurange	D. Kennedy, Morven ..	5 46	350·0	365	10,186·6	614·74
Sweet Clematis ..	A. O. Brown, Kamo ..	5 20	350·0	363	9,174·8	610·01
Woodstock Fantail ..	Mrs. A. Banks and Son, Kiwitea	6 13	350·0	365	10,723·2	604·65
Jersey Meadows Iris	H. H. Phillips, Te Rehunga	8 43	350·0	317	9,703·4	573·30
Flight's Folly ..	N. Moore, Tapanui ..	8 319	350·0	365	9,551·4	507·67
Dominion Blue Bird ..	Ruakura Farm of Instruction, Hamilton	5 5	350·0	365	9,098·2	499·56
	FRIESIANS.					
Junior Two-year-old.						
Dominion Betty Frisby	Central Development Farm, Weraroa	2 76	248·1	350	12,491·6	420·30
Hobson Nettie Pontiac†	Hobson Farm, Ltd., Whare-papa	2 125	253·0	365	11,517·0	406·82
Hobson May Pontiac†	Hobson Farm, Ltd., Whare-papa	1 330	240·5	327	10,244·9	361·80
Hobson de Kol Lady†	Hobson Farm, Ltd., Whare-papa	2 38	244·3	350	10,316·6	355·49
Hobson Rag Apple Pontiac†	Hobson Farm, Ltd., Whare-papa	2 54	245·9	362	9,090·4	327·92
Hobson Ashburn Pontiac†	Hobson Farm, Ltd., Whare-papa	2 52	245·7	319	8,780·7	322·34
Hobson Pet Mercedes†	Hobson Farm, Ltd., Whare-papa	2 87	249·2	314	8,114·4	304·80
Hobson McKinley Posch†	Hobson Farm, Ltd., Whare-papa	2 64	246·9	305	8,651·1	294·28

LIST OF CERTIFICATES—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		FRIESIANS—*continued.*				
Junior Two-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Hobson Tinie Johanna†	Hobson Farm, Ltd., Wharepapa	2 4	240·9	365	9,091·5	293·80
Hobson Princess Acme†	Hobson Farm, Ltd., Wharepapa	2 71	247·6	326	8,354·2	289·06
Hobson Sunflower Pontiac†	Hobson Farm, Ltd., Wharepapa	1 340	240·5	315	8,379·2	269·23
Senior Two-year-old.						
Dominion Olga Colantha	Central Development Farm, Weraroa	2 355	276·0	365	12,016·5	423·41
Junior Three-year-old.						
Fendalton Sylvia Posch*	J. I. Royds, Christchurch ..	3 50	282·0	365	18,145·3	580·37
Empress Pontiac Valdessa†	Hobson Farm, Ltd., Wharepapa	3 146	291·6	342	11,935·0	389·62
Hobson Sunflower Segis†	Hobson Farm, Ltd., Wharepapa	3 106	287·6	263	8,830·0	295·12
Junior Four-year-old.						
Pareora Hero Fancy*	A. S. Elworthy, Timaru ..	4 64	319·9	365	16,555·1	663·21
Senior Four-year-old.						
Oakland Springhill 2nd†	Hobson Farm, Ltd., Wharepapa	4 309	344·4	305	11,703·3	457·92
Mature.						
Fendalton Alcartra Rozine*	J. I. Royds, Christchurch ..	5 10	350·0	365	19,907·7	667·36
	MILKING SHORTHORNS.					
Senior Four-year-old.						
Dominion Mignonette of Ruakura	Ruakura Farm of Instruction, Hamilton	4 347	348·2	344	12,713·7	378·47
Mature.						
Dominion Sis of Ruakura	Ruakura Farm of Instruction, Hamilton	6 300	350·0	283	10,440·2	391·53
	AYRSHIRES.					
Two-year-old.						
Dominion Cherry Lass	Ruakura Farm of Instruction, Hamilton	2 80	248·5	361	9,543·1	406·67
Dominion White Blair	Ruakura Farm of Instruction, Hamilton	2 362	276·7	365	9,399·6	394·05
Dominion Daphne's Pride	Ruakura Farm of Instruction, Hamilton	2 238	264·3	342	7,360·8	284·48
Three-year-old.						
Mahoe's Fairy Girl ..	Atkins Bros., Manakau ..	3 16	278·6	332	10,143·8	387·17
Mature.						
Greenfields Sprightly 3rd*	Webb Bros., Levin ..	7 68	350·0	365	16,766·9	632·27
Dominion Newton Jean	Ruakura Farm of Instruction, Hamilton	5 20	350·0	365	11,468·7	390·26

LIST OF CERTIFICATES—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	RED POLLS.					
Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Dominion Miss Superior	Central Development Farm, Weraroa	2 363	276·8	365	11,223·7	443·64
Dominion Bright Eyes	Central Development Farm, Weraroa	2 0	240·5	354	6,244·9	303·54
	Second-class Certificates.					
	Jerseys.					
Two-year-old.						
Kahuwera Topsy ..	Johnson Bros., Pirongia ..	2 7	241·2	365	9,302·7	508·56
Linden Grove Kitty ..	W. R. Jamieson, Parewanui	2 347	275·2	365	7,799·0	498·49
Croydon Princess Charm	W. Crosby, Waipuku ..	1 349	240·5	365	7,539·65	451·27
Three-year-old.						
Ivondale Lady Aster	G. A. Mills, Ngahinapouri ..	3 205	297·5	365	11,601·4	612·29
Four-year-old.						
Bouquet's Carnation	J. A. Blake, Waipawa ..	4 35	317·0	364	8,219·5	430·93
	Friesians.					
Junior Two-year-old.						
Hobson Zozo Pontiac†	Hobson Farm, Ltd., Whare-papa	1 352	240·5	352	11,725·6	448·85

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Journal* from 17th November to 15th December, 1927, include the following of agricultural interest:—

No. 56688: Sheep-shear comb-plate; F. G. W. Bristow, Sydney, N.S.W. No. 58188: Fencing-standard; A. Christie, Napier. No. 59310: Sheep-shearing-machine tension-nut; R. A. Lister and Co., Limited, Dursley, England. No. 57359: Seed-distributor (for horseback); J. Purchase, Johnsonville. No. 57638: Milking-machine; L. F. Ellery, Invercargill. No. 57946: Hoisting-device; A. J. Pascoe, Lincoln. No. 58048: Cow-cover; E. Jones, Hamilton. No. 59228: Wire-strainer; J. Butel, Mataura. No. 59314: Sheep-shearing machine; A. B. Clark, Sydney, N.S.W. No. 56955: Conversion of motor chassis to tractor; G. Burges, Palmerston North. No. 58545: Drain-plough; E. P. Dickhoff, Shannon. No. 59117: Milk-holder; T. MacDonald, Uruti.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, price 1s. All fees must be paid in advance in cash, or paid to the Public Account at a branch of the Bank of New Zealand and the bank receipt sent to the Patent Office; or fees may be remitted by Post Office order or postal note.

New Rabbit District.—The Banks Peninsula Rabbit District has been constituted, for the purposes of Part III of the Rabbit Nuisance Act, by Order in Council gazetted, together with details of boundaries, on 22nd December, 1927. The previously existing Rabbit-proof Fencing District has been abolished coincidently.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

SPARTINA GRASS.

C. J. CLAASEN, Rawene :—

I enclose cutting from an English paper regarding rice-grass (*Spartina Townsendii*) and would be glad of an opinion on same. Is the grass on the market anywhere in New Zealand, and has it been tried out anywhere here? Do you know if it would be of any use trying to grow it on the heavy mangrove flats of Hokianga Harbour? Has it any feeding-value for stock, and would it be inclined to spread too much?

The Fields Division :—

Spartina Townsendii, also known as rice-grass, has been grown in a few places in New Zealand, but we are not certain whether you can buy roots of the grass on the market. It would be a useful experiment for you to try it on the heavy mangrove flats of Hokianga Harbour. You should sow it on the upper tidal zone; it grows best in the soft mud of the flats. Some roots were distributed from Auckland in 1925. A settler, Mr. A. Glyn Fell, of Waihutu, Opononi, who tried some, reported that the roots spread and were quite vigorous-looking, appearing in little clumps, and he saved some seed. Some roots were also tried at Onerahi, Whangarei Harbour. Mr. K. W. Dalrymple, Bull's (Lower Rangitikei), introduced some plants in 1913, and reported in 1925 that the plants were spreading fairly rapidly, but were slow at first. The grass had collected the mud about itself where it was first planted about twelve years ago. He further remarked that the level was some 2 ft. higher and almost above ordinary tidal level. The evidence we have in New Zealand is too slender yet for any definite opinion to be passed on this grass; experiment will have to be carried further. In England, where they have had over fifty years' experience with Spartina, they do not appear to have decided its value as a forage, but suggest that it may be profitably used for grazing stock, for litter, hay-making, or for the manufacture of paper. One report from Poole Harbour shows that cattle go down to the marshes and eat the plant. It spreads fairly slowly, judging by the experience we have had in New Zealand, and it does not appear that it would become a nuisance, except where it might detrimentally affect navigation in tidal rivers. *Spartina Townsendii* may be (and has already been) confused with Canadian wild rice or rice-grass (*Zizania aquatica* Linn.) found on the Northern Wairoa River. This resembles raupo, and is regarded by settlers fronting the river as a pest. For further information you are referred to the *N.Z. Journal of Science and Technology*, Vol. 7, No. 4 (1924), "Spartina Grass and its Introduction into New Zealand," by H. H. Allan.

DISEASED LEMON-TREES.

W. B., Pukekohe :—

I have two lemon-trees that lost their leaves, with dropping of the fruit. The fruit showed a soft spot on the side, and turned bad if not destroyed by burning or otherwise. Could you advise me what to do under the circumstances?

The Horticulture Division :—

The description given of the condition of the lemon-trees is not sufficient to definitely determine the cause of the trouble. It is very possibly caused by lemon brown-rot fungus (*Pythiacystis citrophthora*), which browns the leaves and causes them to fall, and gradually turns the fruit into a soft spongy condition with a light buff colour. This disease is best dealt with by collecting affected fruit at short intervals and destroying it, pruning the trees so that the bottom branches are 2 ft. to 3 ft. up off the ground, and cutting out all dead and affected wood and burning it. As the greatest danger exists in wet weather, when spores

are produced on infected fragments lying on the ground, it is desirable at such seasons to grow a cover-crop to prevent the distribution of spores by rain-splashes. One or two bordeaux sprays, 4–4–40, when the blossoms fall in spring and autumn, will also assist in a large measure to keep the trees in good health.

REVIEW.

"THE POTATO."

THE disorganization of potato-growing in Britain during the Great War, and the serious consequences attending the rapid spread of wart disease about the same time, stimulated alike the breeder and the pathologist in the production of potato varieties immune to that disease, and focused considerable attention on the causes of degeneration of potato stocks, the classification of varieties, and elimination of synonyms. Much work has also been accomplished in other countries, notably the United States of America, but the records are scattered in journals and bulletins not accessible to the average potato-grower. Much of it is of such great value to the practical farmer, the merchant, seedsman, and gardener that there has been a long-felt want for the accumulated information to be reviewed and presented in a form adapted and available to a wider range of readers.

This has now been filled by a book entitled "The Potato," by Thomas P. McIntosh, B.Sc., published by Messrs. Oliver and Boyd, of Edinburgh. The author is an acknowledged expert, who has for many years been intimately connected with the certification of Scottish seed potatoes and other potato work of the Board of Agriculture for Scotland. His conclusions are the result of close observation and mature consideration. One must acknowledge that too many inaccurate conclusions have been made in attempts to explain observations in potato-growing, and perhaps the outstanding feature of the author's presentation is the reserve that marks any statement which cannot stand close examination, and the manner in which he indicates those general statements which may, and those which may not, be accepted as facts.

The book is very conveniently divided into five parts: (1) Historical, (2) Botanical, (3) Reproduction and Propagation, (4) Cultivation and Utilization, (5) Diseases, Pests, and Injuries. As far as possible each of the thirty-three chapters is complete in itself, so that it may be read independently. The botanical and historical parts will appeal mainly to the potato-breeder, but much of the matter has practical application to ordinary commercial seed-potato production, such as the classification of varieties, intervarietal differences, maintenance of pure stocks, and the roguing of field crops. The reproduction and propagation section deals with application of genetics to variety raising, but deals also in a very practical manner with such questions as quality in seed potatoes, and factors influencing the productivity of potato stocks in connection with disease and its relation to origin of seed.

Certainly the most important section in its application to New Zealand is that dealing with disease. While the potato-grower in this country recognizes the effect of late blight, and through shipping his potatoes has had his attention drawn to certain minor diseases and defects in the tubers, he is almost wholly oblivious to the fact that many of our crops are seriously affected by diseases which do not materially affect the table quality of the tuber, but which cause a very serious reduction in yield. Virus diseases which are the most prolific cause of degeneration or "running out" are very fully discussed in the book, and the excellent illustrations greatly add to the value of the text.

The work makes a notable addition to our literature on the potato, and may be unhesitatingly recommended to interested New Zealand readers. The published price is 12s. 6d. net.

J. W. H.

Correction.—In "Answers to Inquiries," *Journal*, November, 1927, page 355, read: "The relative value of hay to silage is 1 lb. hay equals *3 lb. to 5 lb.* silage," instead of "$\frac{3}{5}$ lb. silage."

WEATHER RECORDS: DECEMBER AND CALENDAR YEAR, 1927.

THE Director of the Dominion Meteorological Office (Dr. E. Kidson) reports as follows:—

GENERAL SUMMARY FOR DECEMBER.

As has been remarked in the notes for previous months, a prominent characteristic of the present season has been the frequency with which cyclones have controlled the weather in New Zealand, and during December these conditions were to a large extent maintained. With the exception of a rather intense depression which crossed the Dominion on the 6th, the westerly type of pressure distribution was conspicuous by its absence. The depression mentioned caused strong northerly winds generally, and was accompanied by heavy rain in Westland.

Between the 12th and the 19th a remarkable succession of cyclones moved down from a northerly direction off the east coast, their centres passing just eastward of the Chatham Islands. The precise origin of these storms is unknown, but they maintained low pressures, cold, strong, southerly winds, and dull, wet weather in New Zealand, especially over districts with an eastern aspect. Whereas our pressure variations are generally controlled mainly by systems moving from the west, during this very unusual spell conditions over Australia and the Tasman Sea made little impression on the situation which had developed to the east of the Dominion. Some snow fell in the high country in the centre of the North Island, and some heavy rains were recorded on the east coast of the North Island. In Westland, though the weather was cold, no rain fell. Following this period there was a complete reversal of weather type, and the barometer rising persistently, anticyclonic conditions were maintained until the 28th. Fine and warm weather was in consequence experienced over the Christmas holidays. During the night of the 28th and on the 29th fairly general rains were experienced. These were associated with a cyclone which had moved slowly across the Tasman Sea, the centre crossing the South Island on the 29th.

The total rainfall for the month exceeded the normal in the east coast districts of the North Island from East Cape southwards, and at scattered places on the east coast of the South Island only. Elsewhere it was below normal, the deficiency being considerable in all the western districts.

The weather during the month was unusually changeable, with wide variations of temperature. It was not until the latter end that summer conditions became established. Temperatures were on the average considerably below normal, and garden growth was again checked. Shearing operations were delayed by the cold, wet weather. There was, however, ample feed for stock, and the season continues to be on the whole a good one.

RAINFALL FOR DECEMBER AND CALENDAR YEAR, 1927, AT REPRESENTATIVE STATIONS.

Station.	December.				Calendar Year.	
	Total Fall.	Number of Wet Days.	Maximum Fall.	Average December Rainfall.	Total Rainfall, 1927.	Average Rainfall.
North Island.						
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	1·84	9	1·00	3·28	59·87	50·38
Russell	1·15	9	0·35	2·05	54·28	51·79
Whangarei	1·34	14	0·27	2·49	57·20	60·24
Auckland	1·42	12	0·37	2·84	53·56	44·44
Hamilton	1·45	10	0·60	3·72	52·79	50·36
Kawhia	1·72	10	0·37	3·21	62·20	53·98
New Plymouth	1·66	9	0·69	4·33	63·93	60·35
Riversdale, Inglewood ..	4·31	11	2·05	7·43	101·41	104·48
Eltham	4·10	13	1·99	3·83	60·44	52·43

RAINFALL FOR DECEMBER AND CALENDAR YEAR, 1927—*continued.*

Station.	December.				Calendar Year.	
	Total Fall.	Number of Wet Days.	Maximum Fall.	Average December Rainfall.	Total Rainfall, 1927.	Average Rainfall.
	North Island—continued.					
	Inches.		Inches.	Inches.	Inches.	Inches.
Whangamomona ..	4·17	8	1·12	5·98	74·69	79·50
Tairua	1·92	12	0·52	4·30	60·91	67·18
Tauranga, The Camp ..	1·71	11	0·44	3·47	59·75	53·10
Maraehako Station, Opotiki	1·18	4	0·64	2·82	63·98	52·82
Gisborne	3·69	9	1·05	2·16	42·23	45·89
Taupo	1·20	5	0·79	3·66	45·01	45·10
Napier	2·62	10	1·22	2·30	31·19	36·11
Maraekakaho Station, Hastings	3·28	14	0·98	2·21	38·22	34·81
Taihape	4·68	13	1·22	3·42	41·05	40·01
Masterton	3·91	11	0·93	2·80	43·78	38·71
Patea	1·76	8	0·90	3·35	48·13	45·19
Wanganui	1·30	7	0·49	2·63	31·94	36·68
Foxton	1·39	7	0·50	2·54	37·93	31·88
Wellington	3·17	12	0·76	3·30	43·35	48·11
	South Island.					
Westport	3;13	10	1·75	6·60	66·52	78·27
Greymouth	3·41	8	1·06	8·95	89·90	99·42
Hokitika	3·63	9	1·76	10·70	108·09	116·60
Ross	6·39	5	3·32	12·04	128·92	136·86
Arthur's Pass	10·25	9	3·37	12·02	171·29	156·61
Okuru, South Westland ..	6·03	6	2·50	11·73	*	149·73
Collingwood	4·84	5	2·11	8·01	92·18	97·91
Nelson	2·04	5	1·01	2·69	38·43	37·77
Spring Creek, Blenheim ..	1·50	6	0·73	1·93	29·76	30·59
Tophouse	1·91	5	0·85	5·00	52·86	61·85
Hanmer Springs ..	4·46	11	0·92	3·26	45·15	41·01
Highfield, Waiau ..	2·00	7	0·58	2·51	28·43	33·56
Gore Bay	2·53	12	0·84	2·12	33·88	31·21
Christchurch	2·06	12	0·39	2·06	21·36	25·33
Timaru	2·10	16	0·34	2·41	20·42	22·78
Lambrook Station, Fairlie	0·90	7	0·36	2·33	22·38	24·98
Benmore Station, Clearburn	0·77	6	0·42	1·77	20·37	24·79
Oamaru	2·47	13	0·73	2·15	23·93	21·82
Queenstown	0·42	3	0·23	2·55	27·92	30·64
Clyde	..	..	..	1·79	..	15·29
Dunedin	3·79	14	1·06	3·48	46·63	37·06
Wendon	1·25	8	0·34	2·95	31·60	30·39
Gore	1·84	16	0·30	3·41	34·70	35·17
Invercargill	2·36	14	0·64	4·26	43·43	45·98
Puysegur Point ..	7·73	14	1·52	6·63	99·47	85·55

* Incomplete.

FOOT-AND-MOUTH DISEASE IN BRITAIN.

At date 4th January the High Commissioner for New Zealand in London cabled: "Present position of foot-and-mouth disease is very serious. In November there were 30 outbreaks, distributed as follows: Hants 20, Wilts 8, Bucks 1, Berks 1. During December there were 70 outbreaks as follows: Derby 28, Staffs 10, Warwick 8, Yorks 6, Lincs 5, Notts 4, Lancs 2, Wilts 2, Worcester, Northants, Leicester, Cheshire, and Hants 1 each. Up to 3rd January there have been 14 outbreaks, but all in previously infected areas."